plating

JOURNAL OF THE AMERICAN ELECTROPLATERS' SOCIETY

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SEPTEMBER
1959

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Stripping anodize coatings and whitening cast aluminum alloys without using hydrofluoric acid	CLEP-ETCH "A" SALT / used with nitric acid

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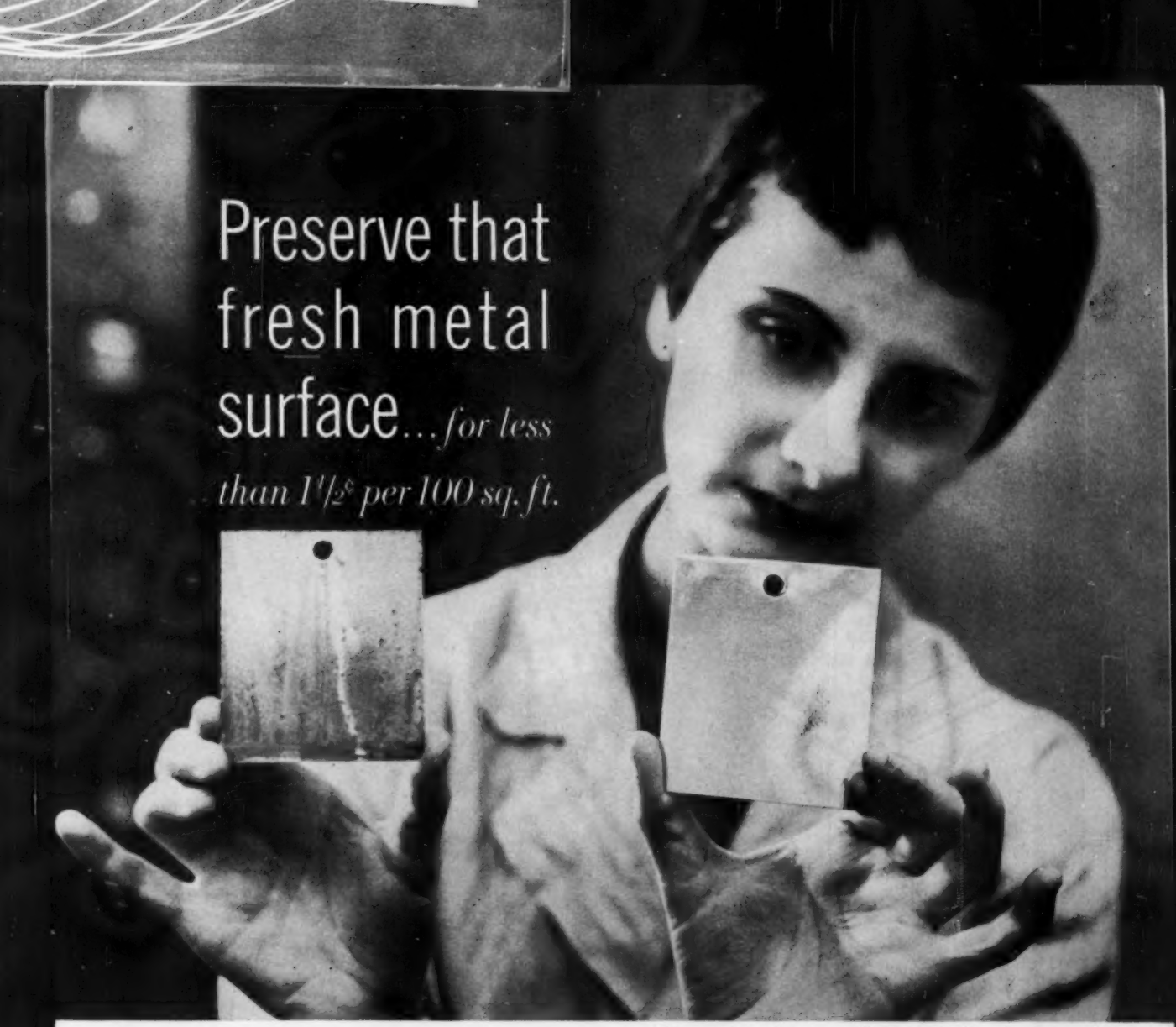

Compare treated vs untreated brass panels. After cleaning, panel on right was rinsed in Entek 45 rinse; panel on left, in standard hot water rinse. Then panels were exposed to 100% humidity at 100° F. for 100 hours. Note how Entek 45 preserves "that fresh metal surface."

From Enthonics research come Enthone Enteks, a new series of rinse water additives which coat metal surfaces with an "invisible shield" against the atmosphere. Entek 45 assures faster drying, eliminates water spots and provides lasting corrosion protection to all metals. Entek CU-55 prevents tarnishing and spotting out of copper and brass even under tropical humidity conditions.

By adding Entek 45 to your final hot water rinse, you can prevent white salt corrosion of zinc and aluminum, prevent yellowing of nickel plate, prevent tarnishing of copper and brass, prevent black spots on cadmium plate.

By treating copper and brass goods or copper or brass plated items with Entek CU-55 you can prevent tarnishing, green salt formation, spotting-out and pit corrosion under high humidity storage conditions.

Entek protection lasts for months, yet costs less than 1½¢ per 100 sq. ft. to treat your parts, less than ½¢ per gallon to make up an Entek 45 solution!

Entek 45 produces an invisible, water-repellent organic film on the metal surface which sheds water rapidly and promotes stain-free drying. This same film acts as an invisible barrier between the metal and the moisture and oxygen in the air.

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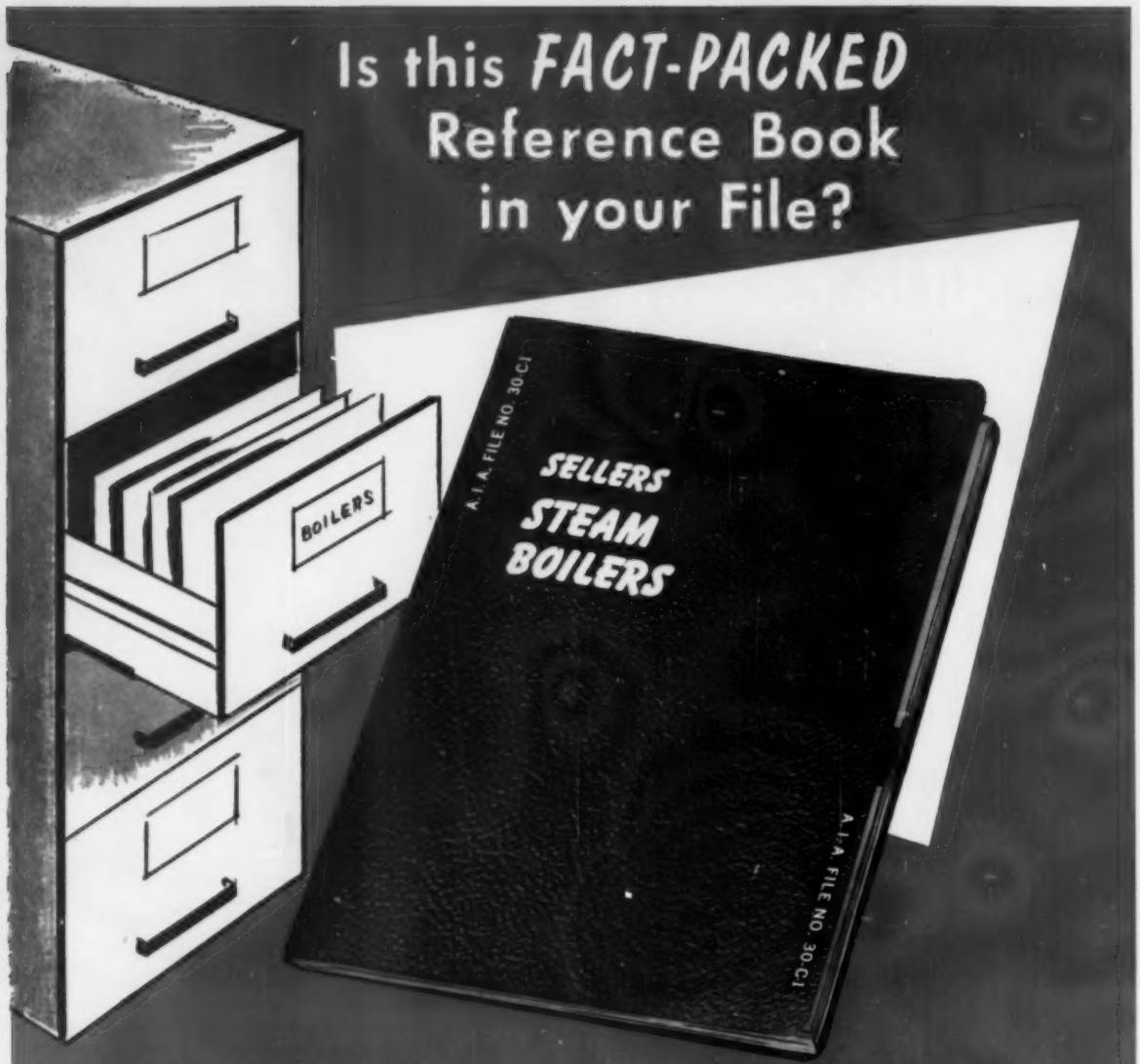

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Published by the American Electroplaters' Society, Incorporated, 445 Broad Street, Newark 2, N. J. Phone: HUmboldt 2-3400. Yearly subscription for Members $2.00. Nonmembers U. S. and Canada $5.00. 65c a copy. Foreign, $8.00 a year, $1.00 a copy. Non-member back issues, Six months or older $1.00 a copy (Golden Jubilee Issue, $2.00 a copy).

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PLATING is indexed in Applied Science and Technology Index and abstracted regularly in Chemical Abstracts, Metals Review, Metallurgical Abstracts, Engineering Index, Technical Data Digest, and Bulletin Analytique.

Statements of fact and of opinion given in articles and papers in PLATING are those of the contributors. The American Electroplaters' Society assumes no responsibility for them.

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Published monthly at 5800 N. Marvine St., Philadelphia 41, Pa. Second class postage paid at Philadelphia, Pennsylvania.

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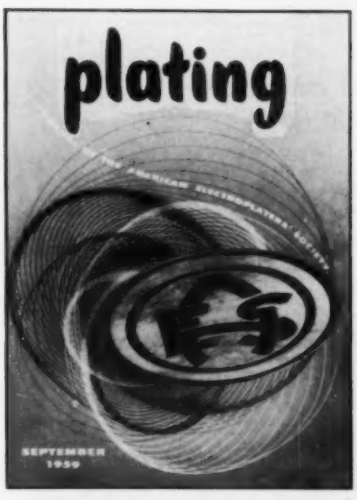

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EDITORIAL

MEMBERSHIP DRIVES: BOON OR BANE?

WITH THE RESUMPTION of Branch activities after the Summer lull, plans are being formulated by Branch Membership Chairmen to inaugurate intensive membership drives. They hope their efforts will be recognized not only by the Branch, but also by the Supreme Society of the American Electroplaters' Society at the Annual Convention when the Branch Membership Promotion Awards' winners are announced.

Branch membership drives are highly desirable and are essential to the growth of the Society. However, overenthusiasm, improperly channelled, may be detrimental to the best interests of the Branch and the Society. Sometimes during these membership campaigns, a prospective member is zealously but imprudently influenced to join. A member thus obtained usually becomes a short-term member and permits his membership to lapse after the pressure is off. Membership suspensions are an unnecessary liability to the Branch and to the AES.

The five-dollar initiation fee is not the criterion for eligibility for AES membership. The Constitution clearly defines the basis for membership, specifying it: "any person interested in the object of the Society—the improvement and dissemination of the knowledge of the arts and sciences of electroplating and of finishing of metals and of allied arts, the development of a cooperative spirit of friendship, and mutual assistance among its members—may become a member." A person requesting membership for reasons other than those stated in the Constitution should be rejected.

As a random example, the Springfield Branch, it is reported, does not rush a prospective member. He is invited to attend several Branch meetings, thus familiarizing himself with the Branch and its activities and its members. This procedure insures that once the prospective member has actually joined, he is definitely interested in the object of the Society as described in the Constitution. Under these circumstances, he will benefit from being an AES member, and in turn, the AES will benefit from his membership.

When a prospect is approached for AES membership, discuss the Society's goal and the value of membership in the American Electroplaters' Society. Members obtained under these conditions will most certainly reduce the yearly suspension list. Our membership drives will then have a real meaning and the end-result will be BOON not BANE.

Manuel Ben
Third Vice President

PLATING MAGAZINE

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This magazine is a member of ABC. Our circulation is audited by experienced circulation auditors. The *facts* thus obtained are issued in ABC reports which show how much circulation we have, how it was obtained, where it is distributed, and other information that tells business men what they get for their advertising money when they invest in these columns.

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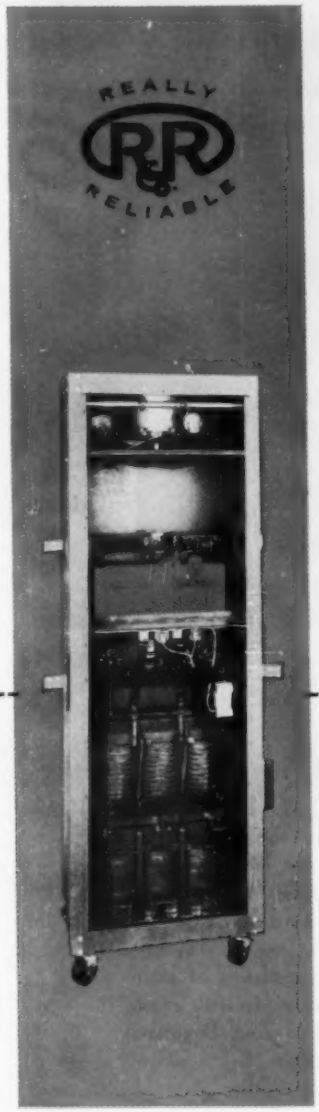

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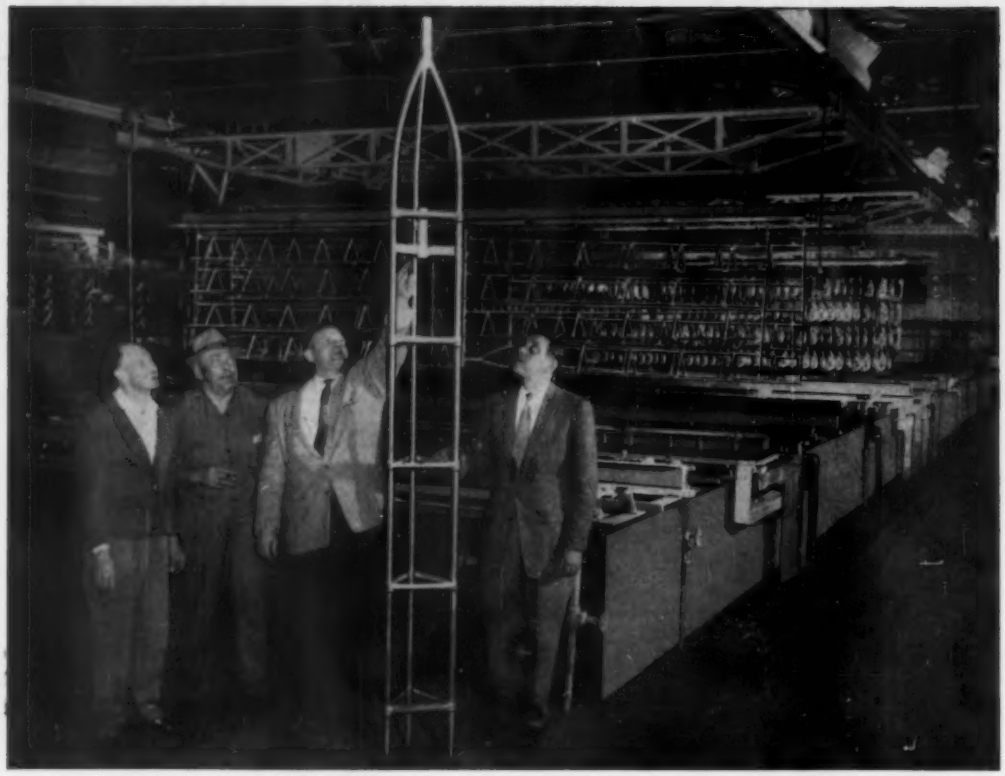

Cliff Stern and Nick Servatius of Modern Plating Corp., Freeport, Illinois; Ed Wild, Ardco, Inc. and Dick Servatius, Modern Plating Corp. are enthused over the results obtained with ROHCO 503 ZINC BRIGHTENER.

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The *Fleximatic* is a return type processing, electroplating or anodizing conveyor. The gross load for one carrier is forty pounds, work and rack. The rack size is a maximum of 18 inches in the direction of travel, 14 inches thick, and 36 inches long with a 9 inch hook. The machine requires a head room of 9 ft. 3 inches and floor space (width) 102 inches wide with 30 inch tanks. The length of the machine can vary to suit any particular application. The shipping dimensions of the machine are 8 ft. 2½ inches high by 7 ft. 6 inches wide. For short machines it will be possible to ship as one unit. The minimum immersion time of the *Fleximatic* is six seconds.

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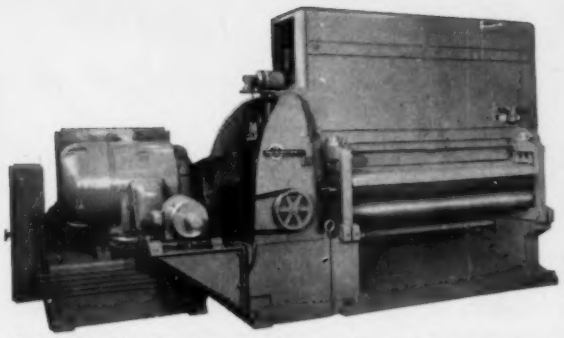
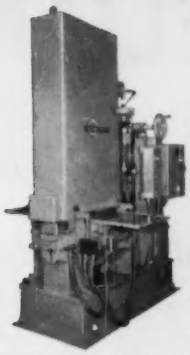
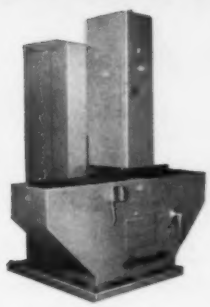


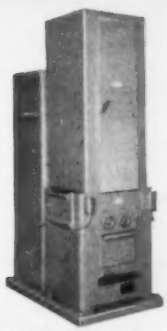
THIS MASSIVE SHEET POLISHING MILL is a pinch-roll type machine to be used for wider flat stock grinding and polishing with belt widths up to 74 inches. A few applications include: prepolishing of stock before forming; polishing stainless steel to standard finishes; upgrading finish of commercial rolled stock; and sizing of various types of sheet and coil stock to engineering tolerances.



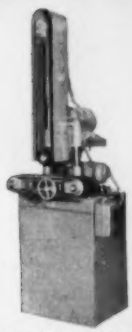
THE MODEL FSP-20 MACHINE is a high production, pinch-roll type for polishing of sheet, coil or bar stock. Printed circuits are typical applications for this model. A series of narrow parts can be run side by side on the machine for increased production requirements.



THE MODEL KC-8 MACHINE is a conveyor belt type for high production of miscellaneous shaped parts having flat surfaces to be ground, polished or deburred. Typical applications include parts for tools, hardware, appliances and automobiles.



THE MODEL KP-8 MACHINE is a pinch-roll type for high production of sheets, coil or bar stock. Square or rectangular tubing and extrusions up to 4 in. thick are other common applications. The design of the machine provides a range from heavy stock removal down to fine finishing.



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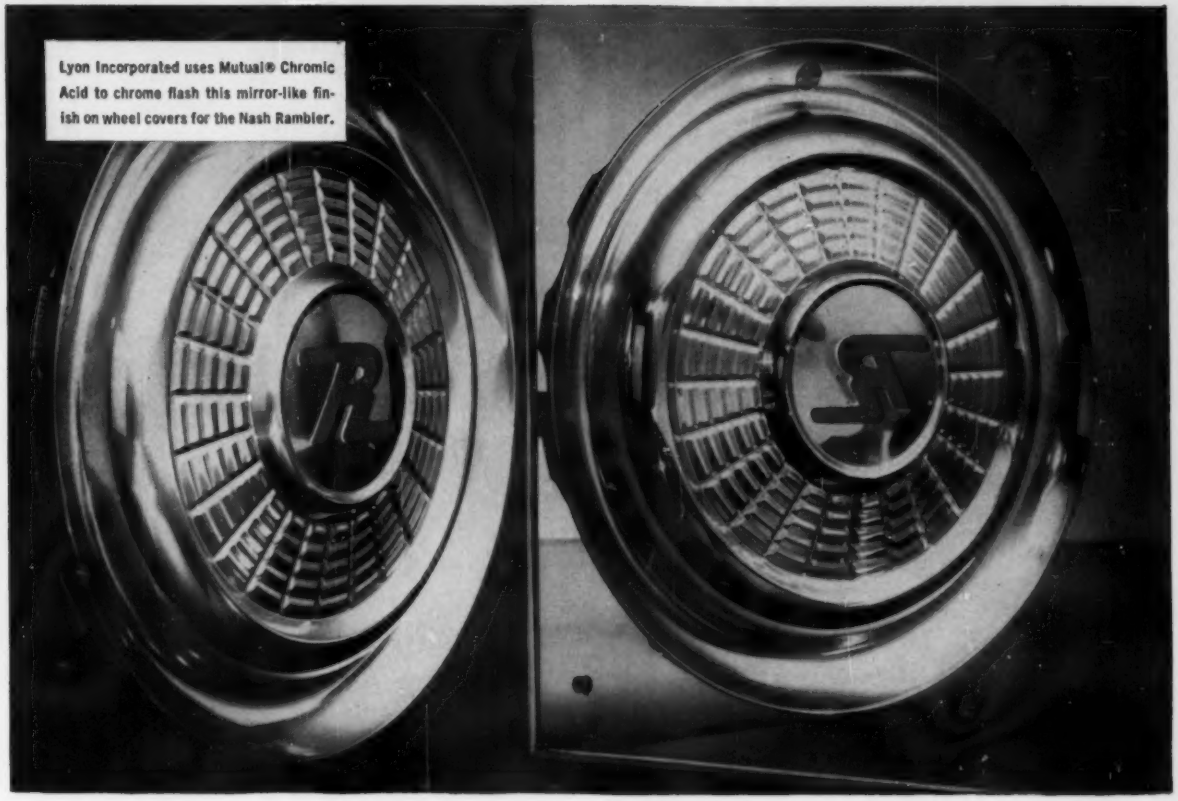

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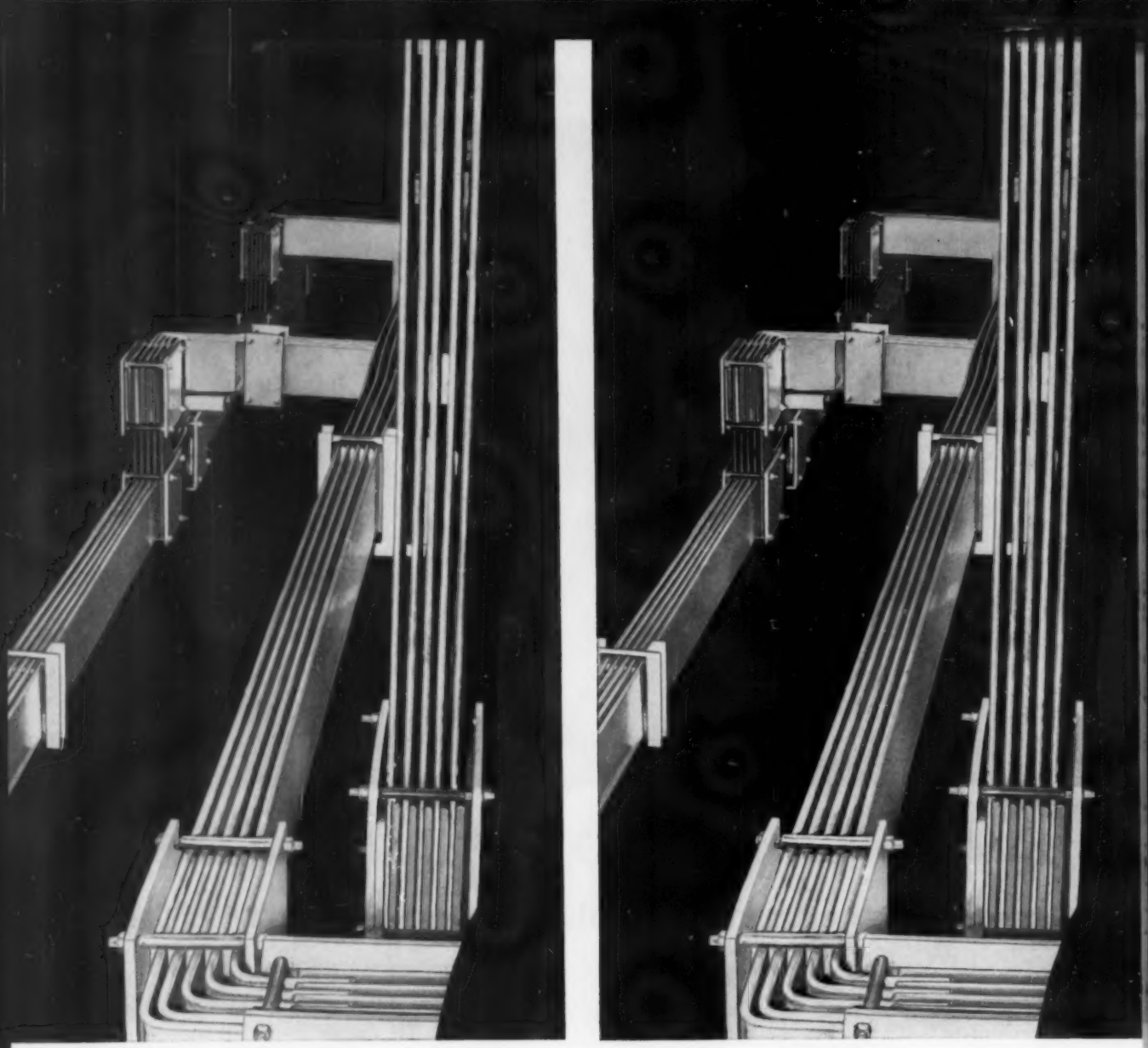

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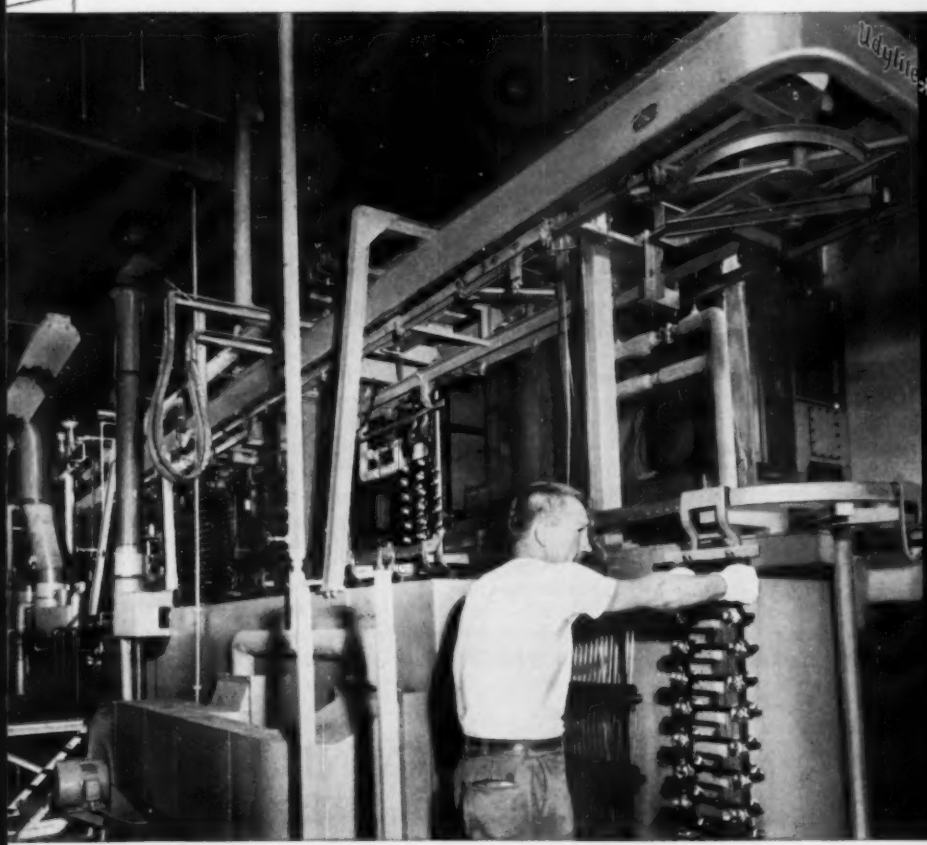

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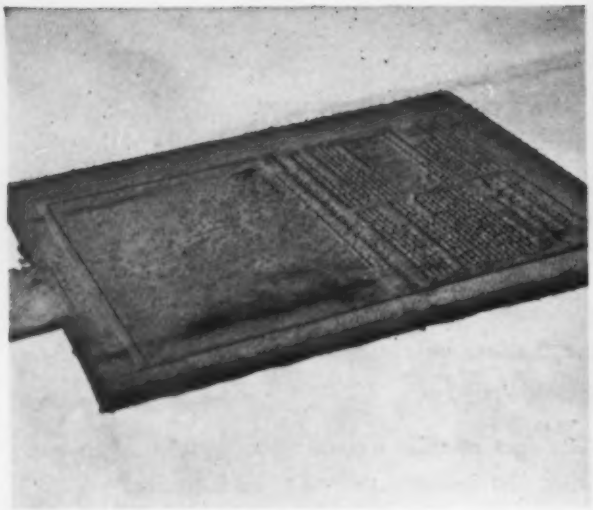

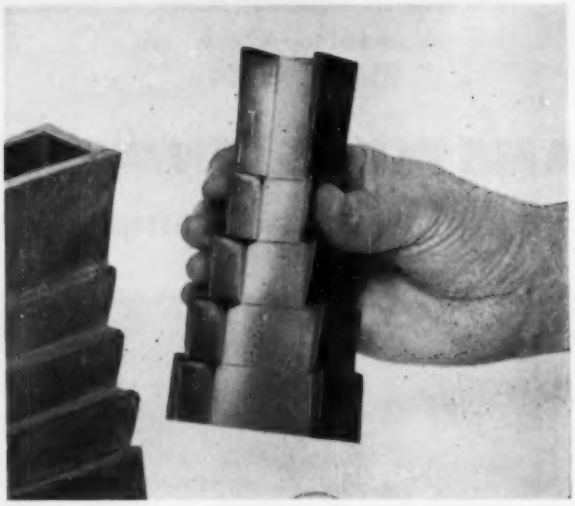

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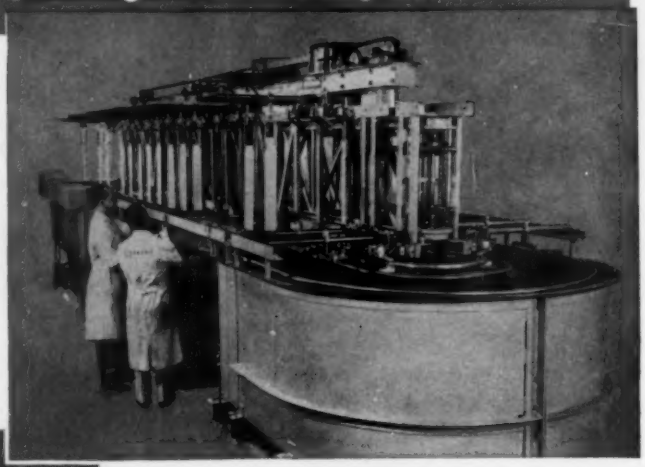

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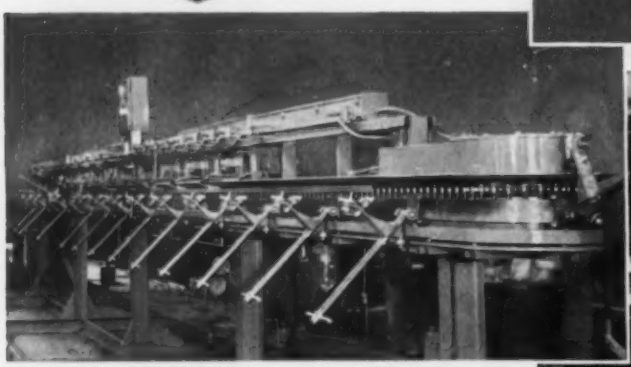

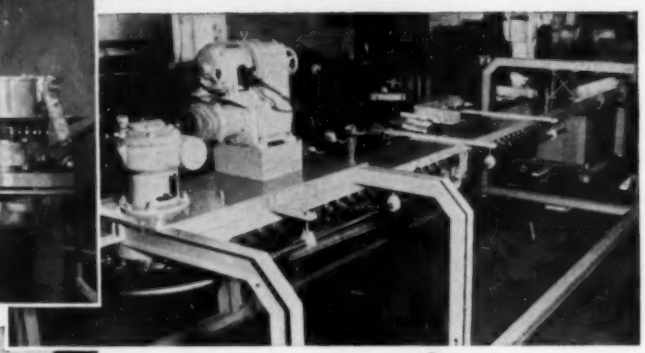

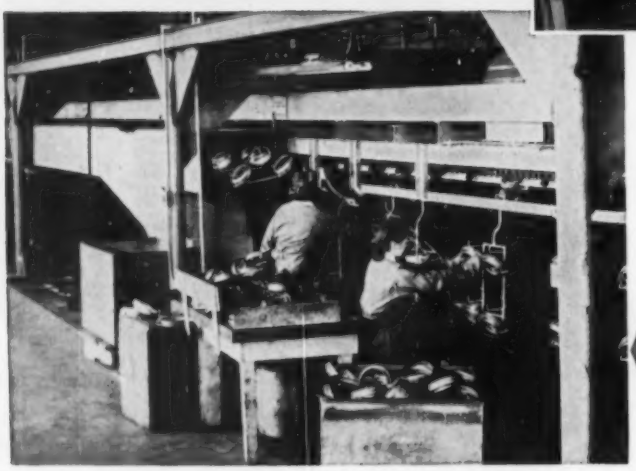

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Hydrogen Embrittlement of Plated Steel Springs by J. A. Gurklis, L. D. McGraw and C. L. Faust, Battelle Memorial Institute for the Signal Corps, U. S. Army. Dec. 1956. 45 pages. (Order PB 151125 directed from Office of Technical Services, U. S. Department of Commerce, Washington 25, D. C., $1.25.)

Cadmium plating does not contribute measurably to the embrittlement of steel springs, according to this report. Anodic etching, or other surface-preparation treatments that avoid acid pickling or cathodic treatment, followed by cadmium plating is a safe procedure for minimizing embrittlement. The study found that procedures involving a cathodic or acid pickle before plating cause embrittlement and that aging following such treatment is not sufficient to restore ductility to steel springs. Baking for 24 hours at 400F is recommended to insure recovery of ductility when using such treatments. The report also states that vise-type and tension-type bend tests are more reliable than constant-rate bend tests for showing up embrittlement. Stress-rupture tests show delayed failures when specimens have been embrittled by cathodic or acid pickling before plating.

American Society for Testing Materials 1958 Proceedings, Vol. 58, 1430 pages, Nonmembers $12.00, AES members $10.80.

This volume records the ASTM technical accomplishments of the year, includes reports and papers together with discussion offered to the society during the year. It includes the summary of proceedings of the ASTM 61st annual meeting, listing by title and author the programs for each session.

The president's annual address by Richard T. Kropf is included. The annual report of the board of directors highlights administrative, technical and financial matters. Included are records of all meetings held by the society and its districts, information on membership gains, publications, honors and awards, and other matters of interest. There are 74 reports of technical committees which together with appendices provide useful information as do the 51 technical papers and discussions on a wide variety of subjects pertaining to research and testing materials.

In addition to the papers and reports, there are listed all symposia and other special sessions published separately as Special Technical Publications, and all papers published in the ASTM Bulletin. An important adjunct is a subject and author index to all papers published in any form by the society in 1958.

Growth of Chromium Coatings from Liquid Metallic Solutions by S. T. Wlodek and J. Wulff, Department of Metallurgy, Massachusetts Institute of Technology. 81 pages. (Order PB 151126 direct from the Office of Technical Services, U. S. Department of Commerce, Washington 25, D. C., $2.25.)

A method was developed for depositing chromium coatings on molybdenum by selectively freezing out the coatings from molten alloys of copper-chromium or tin-chromium. The dilute metallic solutions, when supersaturated by cooling at rates less than 5 to 7C per minute, caused the chromium solute to precipitate preferentially to the molybdenum surface immersed in the melt. Results showed that 10 to 90 per cent of the chromium content of the melts could be deposited within two to four hours on any immersed molybdenum surface to produce excellent adhering coatings of pure chromium 0.001 to 0.004 inches thick. Practical applications of the coating technique are suggested in the production of oxidation resistant coatings on molybdenum and in the densification and joining of molybdenum assemblies. The main plating variables studied were bath composition, homogenizing temperature, cooling rate and forced convection. The study included a theoretical analysis of the nucleation, growth, and morphology of the coatings. Determinations of the solubility of solid molybdenum in liquid copper and tin and solid chromium in liquid tin were made using a simplified weight loss method.

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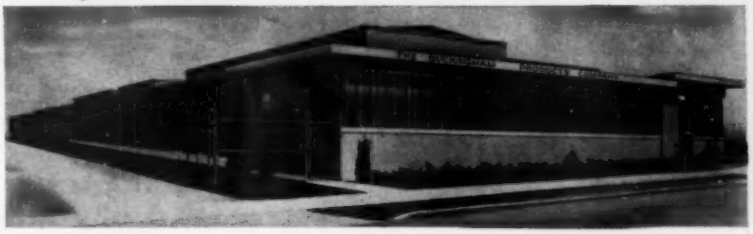

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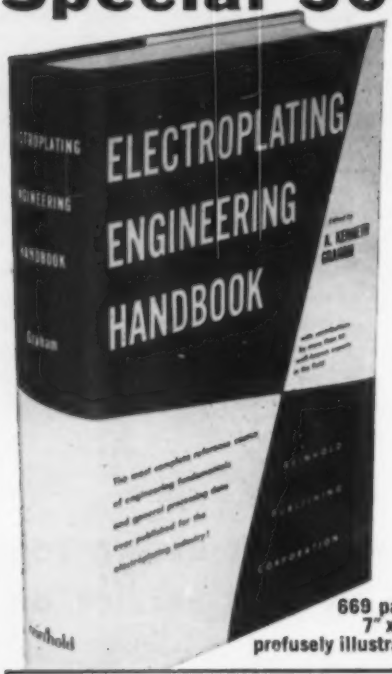

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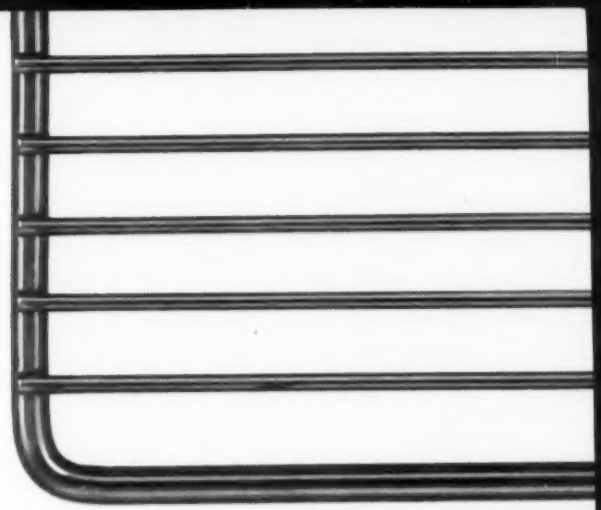

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PRODUCTION OF EMBOSSING PLATES FROM TEXTURE PATTERNS BY ELECTROFORMING METHODS

by JOHN P. YOUNG and VERNON A. LAMB*

An electrolytic process is described by which a large embossing plate is made, on which the pattern is the same as that on a small specimen of material. A number of small plates are electroformed and joined together to make a large master from which the finished embossing plate is electroformed.

1. INTRODUCTION

THE USUAL METHOD OF MAKING a large embossing plate or roll requires a considerable amount of skilled labor, including the copying of the pattern by an engraver, and special machining equipment. The following procedure is typical:

a) Engrave by hand a negative of one or more units of the desired pattern on a soft steel plate. A pattern unit may be $^1/_{16}$ inch to several inches square.

b) Harden the steel plate and from it make a positive impression on a soft steel roll of the correct dimensions, such that the circumference will exactly fit one or more units of the pattern.

c) Harden the roll and transfer the pattern from it to a large plate or roll by making a series of parallel impressions, so that the pattern of each successive impression exactly matches the previous impression.

Work has been done in this laboratory on an electrolytic process for making a large embossing plate on which the pattern is the same as that on a small specimen of material. A number of small plates are electroformed and joined together to make a large plate. Standard techniques of electroforming, machining, and soldering are involved, and any necessary blending of the pattern at the junctures of the small plates is done by engraving.

2. MOUNTING THE SPECIMEN FOR ELECTROFORMING OR MOLDING

The specimen with the pattern to be reproduced is mounted on a rigid sheet of a suitable material, taking every precaution to maintain full pattern depth. If the specimen is a vinyl plastic, for example, it may be cemented to a sheet of Lucite or Plexiglass after making the surface of the latter tacky by applying a small amount of a solvent such as methyl ethyl ketone. The sample must be applied without wrinkles or bulges, yet without enough pressure to deform the pattern. Material which is resistant to plating solutions is metalized, and a negative replica is electroformed on it. The required number of positive replicas are then electroformed on the negative replica.

If the specimen will not withstand plating solutions, a replica must be made in a suitable molding material. Several adhesives and types of backing plates were tried for mounting specimens in preparation for molding. Adhesives that gave satisfactory performance were a solution of polyvinyl acetate in a mixture of hexylene glycol and water, and a water-thinned glue. If the specimen is susceptible to wetting by the adhesive, a minimum amount must be used. Steel sheet was superior to plastic or wood sheets as a backing material for specimens mounted for molding. It does not warp during curing of the molding material and there is no grain to distort the pattern of the sample. Care must be used to insure the smoothness of the sample after mounting. Any unevenness will be reproduced in the electroformed replica. The adhesive must be relatively thin and contain no lumps or hard particles. Knots or coarse threads on the back of a coarse textured sample must be sheared off before cementing it to the backing plate. Excess adhesive is removed by stroking the surface with a soft cloth from the center toward the edges. The adhesives are cured by heating at 100C for five to ten minutes.

An alternate method has been devised for holding materials which must not be damaged by cementing. A commercially electroformed screen* which has no "weave" pattern, but has very fine, evenly spaced openings, is mounted over a perforated backing plate and supports the specimen. This assembly is placed on the open side of an otherwise air-tight container. Portions of the screen not covered by the specimen are covered with sheets of an air-tight material and the container is connected to a vacuum line. Air pressure holds the sample flat against the screen while a mold is made of the pattern.

*National Bureau of Standards, Washington, D. C.

*C. O. Jelliff Co., Southport, Conn., or Buckbee Mears Co., St. Paul 1, Minn.

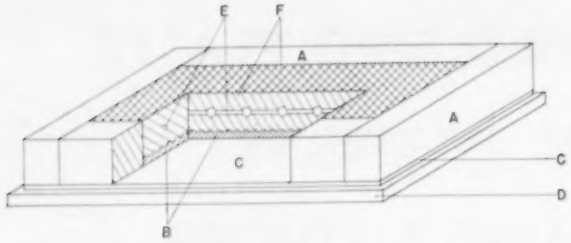

Fig. 1. Assembly for molding a replica of an embossed sample.
A—Dam to hold molding material
B—Embossed sample
C—Adhesive
D—Backing plate of steel or high temperature plastic
E—Wire grid for reinforcing mold
F—Molding material

3. DUPLICATION OF THE PATTERN BEFORE ELECTROFORMING

3.1 Selection of A Molding Material

A suitable molding material should (1) not react with the surface of the sample, (2) reproduce fine detail accurately, (3) be dimensionally stable, (4) separate easily from the sample, (5) cure at a low temperature and in a short time, and (6) be suitable as a base for electroforming. Several molding materials were tried. Those listed below gave satisfactory results.

a) "Geon-121"* mixed with a suitable amount of plasticizer such as "S/V Sovaloid."** This is a vinyl polymer that yields a flexible mold with good pattern reproduction.

b) "Marcokit resin No. 29."*** This is a thermosetting polyester that forms a good rigid mold. Molds of this material are difficult to separate if the specimen has cracks or loose fibers on its surface.

c) "Silastic RTV-501."**** This is a silicone-rubber molding compound which is separable from certain plastic finishes which adhere to "Geon-121." However, it requires 18 to 24 hours to cure and occluded air is difficult to remove.

3.2 Making A Mold of the Pattern

After the specimen has been mounted, a suitable form or dam must be provided to contain the molding material. Square brass rod of the proper cross section, clamped or screwed together, is satisfactory. (See Fig. 1). The brass does not adhere to the above molding materials and is heavy enough to prevent leakage at the edges of the sample.

Flexible molding materials must be stiffened to prevent distortion of the subsequent electroform. A grid, formed from heavy wires soldered together, of a size that fits inside the dam, may be imbedded in the mold. An extension of the grid forms a hook for holding the assembly during electroforming. A perforated steel plate is more rigid than the wire grid, but makes the elimination of air pockets, formed while pouring the mold, more difficult. The air occluded in the molding material during mixing must be removed. This is accomplished by placing the mixing vessel in a suitable container such as a vacuum desiccator and applying a reduced pressure for a period of time depending on the viscosity of the mixture. The mixture is then poured over the specimen, care being taken that air bubbles are not trapped on its face. In some instances the mixture was placed under a reduced pressure after pouring and before curing. This step was found not to be essential to obtain a good mold.

The "Geon" resin is cured by heating at 100 to 110C for one hour. The polyester resin and the silicone rubber do not require heating. Curing over-night at room temperature is required for the latter. After curing, the dam is removed and the mold carefully separated from the specimen. If the face of the mold is damaged due to sticking it is unusable. Specimens which tended to stick to the mold were sprayed with a thin coat of a silicone mold-release compound. This treatment helped in separating the mold, but made its subsequent silvering more difficult.

3.3 Control of Metal Distribution

Prevention of build-up of excessive thickness of electrodeposit at the edges of the electroform is accomplished by use of either a "thief" or a shield. A "thief" is a cathodic wire around the periphery of the mold. It prevents the build-up of a heavy deposit at the outer edges of the mold. A shield, in the form of an open-faced plastic box, as shown in Fig. 2, serves the same purpose and was found to be preferable to a "thief." The edges of the box extend for ½ to ¾ inch at right angles to the face of the work. A shield of these dimensions yields adequate uniformity of deposit thickness for plates up to 5 inches square.

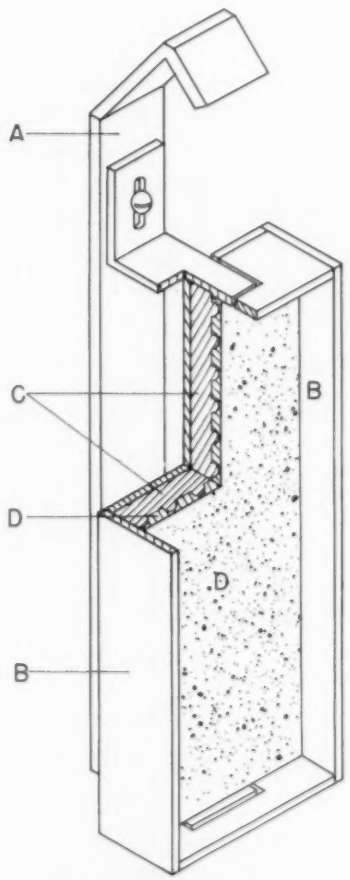

Fig. 2. Assembly for electroforming a replica of a mold.
A—Copper hanger and contact
B—Plastic box to equalize deposit thickness
C—Metalized mold or mounted sample
D—Electroform

*B. F. Goodrich Chemical Co., P.O. Box 954, Bells Lane, Louisville, Ky.
**Socony Vacuum Oil Co., 150 E. 42nd St., New York, N. Y.
***Marco Dept. of Celanese Corp. of America, Linden, N. J.
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4. METALIZING THE SURFACE OF THE MOLD

It is necessary to apply a conductive coating to the surface on which the electroform is to be deposited, whether it is the surface of the sample or a mold made from it. One method, tried without success, was the inclusion of a conducting powder in the molding material. It was found necessary to include so much of the powder to obtain sufficient conductivity that the desirable physical characteristics of the mold material were destroyed. Coating the surface with electrotypers graphite resulted in slow and incomplete coverage during electrodeposition and painting the surface with lacquer containing bronze or silver powders resulted in excessive loss of surface detail.

The only satisfactory method for obtaining a conducting surface was to apply, by chemical reduction, a coating of silver or copper. Since the chemicals for applying silver films were more readily available, silver was mainly used. Since the reduction process for silver is well known and fully described in the literature, it will not be described in detail.[1, 2] The reducing agent used was sucrose, and the sensitizing agent was a solution of 1 g of stannous chloride in 150 ml of isopropyl alcohol.[3] This solution sensitizes organic resin surfaces more uniformly than does an aqueous solution. It must be freshly prepared for each application. The mixed silvering solutions may either be poured over the work or applied with a special spray gun. Only an amount of ammoniacal silver nitrate solution required for immediate use should be prepared, and the spent solution should be acidified with hydrochloric acid, because explosive compounds may form in alkaline ammoniacal silver solutions that are stored longer than a few hours.

5. ELECTROFORMING A REPLICA OF A PATTERN

The mounted specimen or mold is rinsed to remove the silvering solution and plated immediately in a copper sulfate bath for a short time (10 to 20 minutes) to "back-up" the silver coating. A coating of nickel 0.01 to 0.02 inch thick is then applied to strengthen the electroform. The remaining thickness of 0.05 to 0.10 inch is built up with copper. The mold and the electroform are then separated and the face of the latter is plated with a flash of nickel or chromium so it will not adhere to succeeding electroforms which are to be deposited on it.

5.1 Electroforming Solutions

Both nickel sulfamate and Watts baths were used for nickel plating. The former is desirable because the characteristic low stress of nickel deposited from sulfamate baths tends to prevent warping of the electroform. However, because of the intermittent operation of the bath, it was difficult to prevent pitting of the deposits. The Watts bath, operated at a *p*H of 4.0 to 4.5, gave deposits sufficiently low in stress[4] and was easier to maintain.

The copper was deposited from a standard sulfate bath. An addition agent may be used to increase the smoothness and hardness of the deposit.[2, 5, 6] Both glue and a proprietary addition material have been used with reasonably good results.

6. SEQUENCE OF OPERATIONS TO MAKE A LARGE PLATE

Several successive electroforms may be required to obtain an embossing plate that is a negative of the pattern on the specimen (Fig. 3). If a negative can be electroformed directly on it, the first step (a) below is eliminated.

(a) Electroform a positive plate from the negative pattern on the plastic mold. Separate the positive from the mold, plate it with a flash of nickel, and passivate by immersing it in a solution of sodium dichromate.

(b) Electroform a negative plate on the positive pattern obtained in step (a), or by plating directly on the sample. This is a master negative plate. A metal master is necessary to withstand the mechanical and chemical processing that is required in the course of electroforming several positive replicas.

(c) Electroform on the negative master as many positive replicas as are needed for the final embossing plate.

(d) Using standard electrotyping procedures, (1) cast type metal on the backs of the positive replicas, (2) shave the type metal (preliminary cut) to an oversize thickness, (3) mechanically straighten the plates, (4) shave the type metal (final cut) parallel to the face of the pattern, to a uniform thickness.

(e) Assemble the plates as follows:

(1) Mark the boundaries of the pattern unit nearest the edges of the plates and mill off the excess exactly to the mark.

(2) Bevel the edges away from the face of the plates. (See Fig. 3, G).

(3) Assemble the plates edge-to-edge and clamp to a flat face plate with the pattern side down.

(4) Solder the pieces together from the back.

(5) Solder pieces of brass angle to the back of the assembly for increased rigidity.

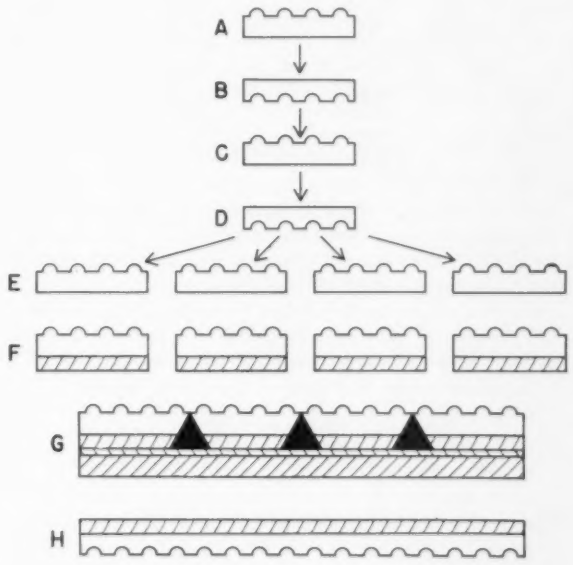

Fig. 3. Sequence of steps used to produce a large embossing plate.

A—Original embossed specimen
B—Negative impression in molding resin
C—Nickel-copper positive
D—Nickel-copper negative
E—Nickel-copper positives (if desired, multiple negatives as in D may be produced instead)
F—Nickel-copper positives straightened and backed
G—Nickel-copper positives machined, soldered together, and reinforced
H—Large nickel-copper negative, cemented to steel backing to form final embossing plate

(f) Work out by engraving procedures any irregularities in the matching of the positive pattern at the junctures of the assembled plates.

(g) Passivate the surface of the assembly of positive plates and electroform a full-size plate on it, upon which the pattern is a negative of that on the original sample. This is the embossing plate. If necessary, work out any remaining irregularities by engraving. Chromium plate the face, if desired. Machine the back of the plate flat and attach a steel backing to it with a thermosetting resin, if greater rigidity is needed. The embossing plate is now ready for use.

7. ALTERNATIVE AND SUPPLEMENTARY PROCEDURES

7.1 Use of A Positive Master

In some cases it is desirable to use an electroformed positive master to emboss or mold a softer, easily replaceable plate, which in turn is used to emboss a cloth or plastic. If the assembled electroformed positives (sec. 6f) require very little "touching up" to eliminate joint marks, this plate may be used to mold plastic plates. An electroformed positive should be made by proceeding one step beyond 6g, if joint marks are still evident or if pressure is required to make the softer plate. Pressure on the assembled positive mold will separate the soldered joints.

7.2 Forming A Plastic Mold On A Plastic Master

An attempt was made to eliminate one electroforming step (sec. 6a) by making a positive plastic mold directly from the negative plastic mold of the sample. Molding Geon to Geon was tried, but was found to be unsatisfactory due to local adherence. Further work with other plastics or separating procedures might result in a successful combination.

7.3 Increasing the Pattern Depth

The depth of the pattern may be increased by taking advantage of the poor throwing power of chromium plate. By plating with a high bath temperature and a low current density[5, 6, 7] the relative thickness on elevations and recesses, respectively, of a given pattern may be as high as 3 to 2. Either a positive or a negative of the pattern may be plated in this manner. The choice depends on which will give the greatest variation in plate thickness, and corresponding increase in pattern depth, together with a minimum of distortion of the pattern.

7.4 Electroforming of An Embossing Roll

As described in the introduction, mechanical methods for reproducing patterns may involve embossing a small roll. If transfer equipment is available, making a small roll by electroforming may be advantageous. This procedure was attempted with some success.

The flexible specimen was cemented to the outside of a tube about 1½ inches in diameter. The exact diameter depends on the size of the pattern unit. A "Geon" mold was made of the pattern on the tube, its surface metalized, and an electroform made on it. The result was a cylindrical tube with a positive of the pattern on its outside surface. This electroformed shell was machined smooth on the inside and mounted on a steel arbor. Several small rolls have been electroformed in this manner, but they have not been used to transfer the pattern to a steel plate. To impress soft steel, the electroformed roll should have a hardness in the range of 400 to 500 Vickers. This hardness could be obtained by electroforming the roll with hard nickel,[8] cobalt-phosphorus alloy,[9] or cobalt-tungsten alloy.[10]

ACKNOWLEDGMENTS

We acknowledge the contributions of the following persons, who worked on this program consecutively over a period of several years; Virginia D. Hill, W. H. Metzger Jr., Charles Schreyer, W. E. Reid Jr., and Harold Shapiro. We also thank the personnel at the Government Printing Office, who applied type-metal backings to the electroformed replicas.

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EVALUATION of ADHESION of THICK ELECTRODEPOSITS

by HYMAN CHESSIN* and JOHN G. POOR**

INTRODUCTION

THE PROBLEM OF THE DEVELOPMENT and use of proper preplate and plating techniques to insure adhesion of chromium and other deposits for engineering service is often aggravated by lack of a satisfactory test. Several adhesion tests are available for formulation of optimum techniques on a laboratory scale. It is evident, however, that the translation of plating techniques from the laboratory to production can and does introduce new variables. The effect of these variables must be checked on work pieces which have been processed in the regular production cycle or the question of adequate adhesion of the electrodeposit to these pieces remains unanswered.

The classical tests of bending, chiseling and grinding are used only in lieu of a more quantitative method, one capable of better classification. In general these tests are capable only of detecting poor bond in production pieces. The "push-out" test, described here, has been used in the laboratories of the Van der Horst Corporation for several years to measure the adhesion of chromium and other deposits such as iron and nickel. It has proved to be very satisfactory. In the hands of an experienced technician it may be used to classify adhesion into a minimum of three categories: excellent, intermediate and poor. The intermediate class is most often subdivided into the classes of good and fair.

THE "PUSH-OUT" TEST

Work pieces or test specimens are ordinarily plated with about 0.002 inch or more of chromium or other electrodeposit by the procedure to be checked. A 0.257-inch diameter blind hole is drilled from the backside of the specimen such that the point of the drill comes within 0.062 inch of the interface between the basis metal and the plate (Fig. 1). After the drill debris is removed from the hole the specimen is placed front (plated) side down on a metal support with a hole about 1.0 inch in diameter. A hardened steel rod (0.250 inch in diameter) is placed in the blind hole in the specimen which is then centered on the large hole in the support. Any convenient size hole may be used instead of those sizes specified above.

By raising this arrangement with a hydraulic jack to a stationary bridge, the rod is pressed against the bottom of the blind hole. Pressure is increased until the rod is pushed through the specimen thereby pushing out a "button" by breaking out the end of the blind hole in the specimen. It is desirable to increase the pressure at a slow and uniform rate to improve the reproducibility of the test.

On brittle basis metals such as cast iron or cast aluminum alloys little deformation occurs and the button has tapering sides (Fig. 2a). With more ductile basis metals, such as steels and wrought aluminum alloys, the button will have almost parallel sides and the face of it will be deformed to a convex surface (Fig. 2b). Examination of the button and of the periphery of the crater under a stereoscopic microscope leads to classification of the quality of adhesion.

DISCUSSION OF INTERPRETATION

Adhesion of an electrodeposit may best be defined in terms of "perfect adhesion." Perfect adhesion occurs when the strength of the interface between the metallic deposit and the basis metal is of the same magnitude as the strength of the weaker of the two metals. We may think of the three elements (1) plate, (2) interface and (3) basis metal, as being links of a chain. The weakest link will limit the strength of the chain. Should this weakest link be link 2, i.e., the interface, then adhesion is something less than perfect and tension or shear will cause parting at the interface. Where link 2 is as strong as either link 1 or 3, whichever is the weaker, parting under stress will evidently occur anywhere in this weaker link as well. This then is an example of perfect adhesion.

In this test method, by pushing out a button, the basis metal, the interface and the electrodeposit are subjected to very severe stresses which cause shear and tear in the metals. Examination of both the button and the crater will determine where and to what extent parting has occurred, and therefore, the quality of the bond.

The surface of the button may first be examined. For an extensively deformed button the chromium will be cracked and there may be some spalling or breaking away of particles of the chromium deposit. Except as there may be clean separation or cleavage at or very near to the basis metal-electroplate interface such cracking may be disregarded. Examination of the underside of the edges of the button will frequently reveal if any appreciable separation has occurred

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** Plant Manager, Spar-Ten Engineering Co., Los Angeles, Calif.

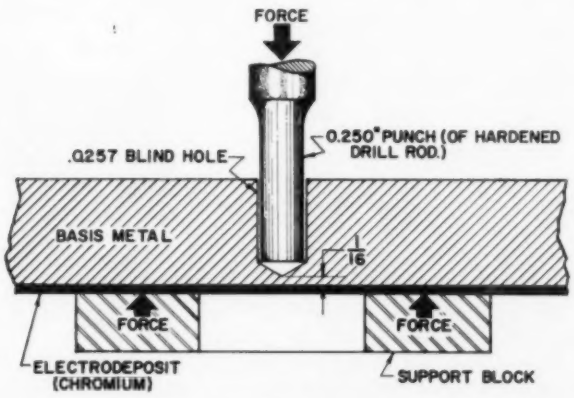


Fig. 1

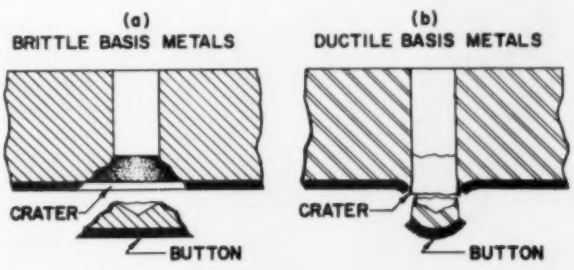
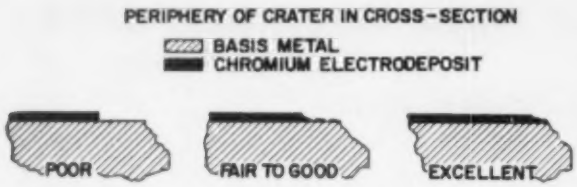


Fig. 2



ADHESION

Fig. 3

at or very close to this interface. Any clean separation at the interface is an indication of poor bond.

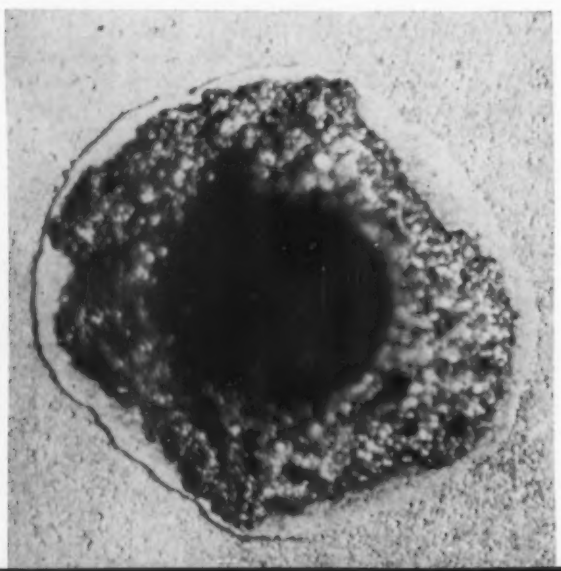
Interpretation is based mainly on examination of the periphery of the crater (see Fig. 3). If clear interfaces show, the bond may be poor to fair depending on the extent (Fig. 4). If, under the stereoscopic microscope, the interface does show, but there is evidence that extensive parting has occurred within the basis metal structure, within the electrodeposit, or within both, then the bond is fair to good and is probably adequate except for the most severe service conditions. Should there be no interface showing and all parting has been in either the basis metal or in the chromium then, by definition, the bond is excellent (Fig. 5).

SUMMARY

A necessarily destructive method has been developed for determining the quality of adhesion of chromium and other deposits to the basis metal. The method is at least as reproducible as bending methods and is a much more severe test, desirable for engineering deposits. Further, it is suitable for use on thick production pieces which cannot be easily subjected to bending tests and particularly where relatively brittle basis metals are involved, e.g., cast iron. The use of the method allows for interpretation based on a fundamental definition of adhesion. Experience and skill in interpretation are readily developed so long as the interpreter has a clear understanding of this definition.

The mechanics of the test are simple and fast. The test, suitable for all basis metals and for chromium and other electrodeposits, has been used for years as a measure of adhesion for both laboratory and production items with complete success.

Fig. 4. Chromium on cast iron. Poor adhesion.



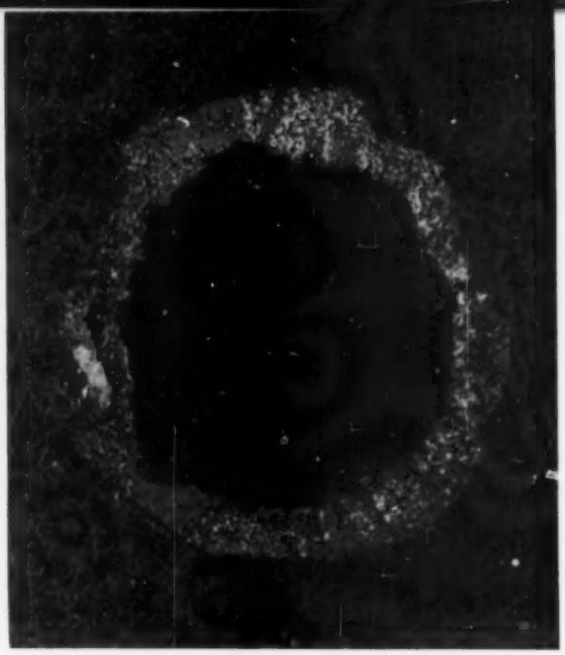


Fig. 5. Chromium on cast iron. Excellent adhesion.

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John G. Poor joined the Van der Horst Corp. of America as plating chemist in 1943 and was appointed director of research in 1948. Mr. Poor's first laboratory experience was gained while with the General Electric Co. for a five year period. He was employed for ten years as plating chemist at the Underwood Corp. Research Laboratory. In addition to Mr. Poor's extensive work in porous chromium plating, he has done considerable work in electrolytic iron. He accepted his present position as plant manager, Spar-Tan Engineering Co., Los Angeles, California in 1958. He is a member of the AES and the Electrochemical Society.

CLEANING and PREPARATION of METALS PRIOR to ELECTROPLATING

XII. EFFECT OF FATTY ACID FILM

by HENRY B. LINFORD* and JEAN J. GRUNWALD**

The effect of fatty acid films on adhesion of nickel deposits on copper has been quantitatively investigated. Stearic acid films were deposited on "atomizer clean"[20] copper specimens by three different methods, and the resulting adhesion of a subsequent nickel coating has been tested by the modified Jacquet[14] procedure. Adhesion values obtained with varying amounts of stearic acid have been recorded.

It was found that a stearic acid film deposited by the Devaux method,[10] and equivalent to 2/3 of a monolayer, will result in adhesion of 420 lb/0.5 inch, which corresponds to the tearing strength of the copper used in the present work. As a result, organic soils not detectable by a properly conducted water break test[21] will not affect the adhesion of nickel plated on copper.

The effect of greasy impurities on hydrogen bubble attachment has been photographically recorded on the immersed plate. It is shown that this phenomenon is extremely sensitive toward greasy impurities and is affected by traces equivalent to <0.05 of a monolayer.

Observation of bubble density appears capable of being developed into a very sensitive test for cleanliness and a useful tool for evaluating "non pitters".

INTRODUCTION

PROJECT 12 HAS BEEN STUDYING the effect of oxide soil on adhesion.[23] This work followed the study by Linford and Feder[17] on the fate of copper oxide on copper basis metal when plated with nickel from a high *p*H Watts nickel bath. The present investigation is concerned with the effect of fatty acid film on adhesion of nickel deposits on copper.

The lack of quantitative data regarding greasy impurities is well illustrated by the following quote from a paper of E. H. Lyons Jr.,[25] "Often, the appearance of 'water break' indicates that the surface is not prepared for plating, but occasionally, a surface showing no water break is not suitable, and in at least a few cases adherent plates have been deposited on surfaces with water break."

The present work has therefore been undertaken with the object of determining the lower limit at which greasy impurities impair adhesion of nickel deposits on copper. It is believed that a better understanding of metal cleaning requirements with regard to grease would result in a more judicious use of the various cleanliness tests, as evaluated by Linford and Saubestre.[19]

LITERATURE SURVEY

An extensive literature research on the topic of organic and inorganic contaminants has been published by Linford and Saubestre[18] and Linford and Feder respectively.[17] Therefore, this section includes mainly summaries of articles and reports which reflect relatively recent developments in this field.

It is generally accepted, that a "perfectly clean" metal surface, i.e., one that is free of foreign atoms can only be prepared and preserved under special care, involving high vacuum condition. This is due to the unsatisfied nature of the Van der Waals and valence forces of the surface atoms, which exhibit great activity, tending to adsorb any atoms coming within their field of attraction. Hence, metal coatings obtained in practical conditions, will mostly be applied onto foreign films of some type, unless they are removed during the initial phase of the plating process.

Ferguson[11] reviews in detail the mechanism, as well as the theory involved in adhesion. Thus it is said, that the forces responsible for adhesion of metallic coatings onto the basis metal are atomic in nature. Accordingly, the degree of adhesion is a function of the intimacy of the contact between surface atoms of the basis metal and those of the deposit. If the deposited atoms come within inter-atomic distance of the atoms of the basis metal, adhesion will reach a very high value.

Interdeposition of any foreign atoms will decrease the forces of adhesion. As to the rate of decrease of the interatomic forces, they are said to fall off as the square of the distance according to some[30] or as the fourth power of the distance according to others.[27]

Qualitative work on the effect of greasy insulating layers on electrodeposition has been done by Marie and Thon.[26] These workers applied tripalmitine on copper and platinum samples by adsorption from an ether solution. The amount of soil retained by the sample was controlled by using tripalmithine-ether solutions of variable concentrations. The soiled specimens were copper plated in a copper sulfate-sulfuric acid bath, and studied for microstructure. Following is a summary of conclusions afforded by the authors on the basis of their experimental observations:

1. Greasy films are never continuous nor uniform, when applied onto metal plates.

2. Metal deposition starts at interstices and discontinuities of insulating films, where direct contact with the electrolyte is ensured. Complete coverage is finally achieved by metallic bridges overpassing and linking insulating points.

3. Adhesion is a function of the fraction of cathodic area on which direct anchoring of the discharged metallic ions

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is possible. Clean surfaces yield maximum adhesion because there are an infinite number of direct contact points between atoms of the basis metal and discharged ions.

4. Electrodeposition on contaminated surfaces results in large crystals which develop at the porosities of the film. Degreased metal surfaces favor fine crystal structure due to uninhibited crystal formation.

5. Destruction or removal of the greasy layer does not occur during electrolysis.

Statement No. 1 above is in conflict with the findings of a number of other workers.[5, 29] Furthermore, in our opinion there is no experimental evidence to substantiate conclusion No. 5.

Lyons[25] gives a detailed discussion on preparation of metallic objects prior to electroplating. He points out that rolled and buffed surfaces are covered with tenaciously adhering films, extremely difficult to remove. If the metal surface is hot it will actually react with the fatty acids, oils and waxes contained in the buffing compounds and lubricants, yielding "a gummy, insoluble soap, iron palmitate, which is extremely difficult to eliminate."

Lyons suggests a probable mechanism by which plating occurs on soiled cathodes when deposited in cyanide baths. Thus he states that "metal is quickly deposited on the cleaner portions after which vigorous gassing occurs on the soiled areas; there is a tendency in cyanide baths for a metal to plate-in under the soil, and at times it may bridge over a dirt particle." He explains the popularity of cyanide plating baths by their powerful cleaning capacity demonstrated by the well known practice of "cleaning and plating in the same bath."

According to Lyons cathodic cleaning is due to gas evolution which breaks up the oily film by bubbles formed directly under the surface of the contaminant.

In the discussion of the same paper[25] it is said that acid plating baths require a higher degree of cleanliness than alkaline electrolytes, which are capable of compensating for deficiencies in cleaning.

In another paper[24] Lyons points out that rarely if ever does a metal surface enter the plating bath without being coated with a foreign film of some type. Since plating on "chemically clean surfaces" is not met with in industrial practice, he defines an object adequately prepared for electroplating as "one on which objectionable surface films have been replaced by films more suitable and acceptable for electroplating."

After providing a well defined classification of the most common type contaminants experienced in the industry, he notes that "slight oil films" should not be objectionable to plating. However, Lyons does not elaborate on this point and makes no attempt to provide quantitative standards.

Further he notes that electrodeposition will proceed on top of surface films, providing they are "thin enough" and conducting. If the film is porous or discontinuous, the metal will penetrate into the pores, and the degree of adhesion will depend on the distribution and number of "penetrations" or "anchors" available. In the majority of platings, adhesion, though satisfactory, is said to be due to such "spotty bonding."

In recent publications, the study of monolayers is being given increasing attention, and some aspects of this research are of interest in metal finishing. Beisher[3] used the radioactive tracer technique in his work on monolayers. Radioactive stearic acid was applied on various supporting materials by the Langmuir-Blodgett procedure,[6] and their radiographic behavior was studied. He found that a monolayer, deposited on a copper plate forms a metal soap with the substrate material. The film thus achieves considerable stabilization and can be stored for an extended period without noticeable change of its activity. Such films are difficult to remove since they are anchored to the basis metal by chemical bonding. They are good lubricants, their mechanical breakdown occurring at a relatively high temperature, close to the softening point of the appropriate metal soap.

Bowden and Moore[6] studied the rate of reaction of stearic acid monolayers with copper plates at room temperature. They report that after a period of two days 90 per cent of the stearic acid monolayer will be converted into metal soap. The process is considerably accelerated at high temperature.

Such chemically bonded films will require vigorous cleaning conditions as already predicted by Lyons.[24, 25]

Metal surfaces coated with fractional monolayers are frequently encountered on most or all surfaces undergoing plating. Such fractional films were studied,[3, 7] and following is a summary of the authors' findings:

1. Incomplete monolayers form small patches of close packed molecules oriented at 90° angles to the plane of the adsorbing surface. The areas surrounding these patches are practically bare of adsorbed molecules.

2. The above arrangement is only achieved with long chain compounds where the Van der Waals forces between adjacent molecules are sufficient to draw them together in close-packed groups. Short chain molecules have little tendency to align themselves vertically on the substrate surface unless they are subject to lateral pressure.

3. Very low concentration of soil will prevent formation of close packed patches, regardless of chain length.

It has been calculated[4] that six or more carbon atoms in the chain are sufficient to make the interaction between adjacent groups dominant.

However, little is known about the minimum soil concentration at which close packing starts.[4]

Adam[1] defines the "work of adhesion" between a solid and a liquid as "the work necessary to separate the liquid from the solid by separating them perpendicularly from each other against the adhesive forces between them." The mathematical expression of the work of adhesion can be written as follows:

$W_{solid\text{-}liquid} = gamma_{la}\ (1 + \cos \Theta)$, in which $gamma_{liquid\text{-}air}$ is the surface tension of the liquid against air.

Θ is called the contact angle of the liquid against the solid.

If $\Theta = 0$, $W_{sl} = 2\ gamma_{la}$, and the liquid is said to attract the solid to the same extent as it attracts itself.

For $\Theta = 90°$ we have $W_{sl} = gamma_{la}$, the liquid attracts the solid half as much as it attracts itself.

If $\Theta = 180°$ there is no attraction of the liquid to the solid. Such condition is said to be unrealizable.

Thus the contact angle is a convenient means for expressing wettability of solid surfaces. A metal surface presenting a contact angle larger than 90° against water is said to be unwettable.

Clean metal surfaces have zero contact angle (good wettability for water). Partly soiled objects will have contact angles between 0° and 90°. Surfaces previously cleaned and immersed into solutions containing fatty acids will emerge with an increased contact angle against water. The fatty acid molecules are said to diffuse through the solution and to

be adsorbed to the substrate by their polar end.[16] After the film population has reached a certain density they start orienting themselves with the CH_x– groups outwards. The hydrophobocity of the emerging surface depends on the solute concentration, *p*H and immersion time.

It is interesting to note that according to Shafrin and Zisman[29] the limiting contact angle is a function of the number of carbons in the chain and is independent on the method of application of the monolayer, providing maximum adsorption is ensured. He thus assumes that by applying to the plate a pre-oriented and condensed monolayer as is the case in the Langmuir-Blodgett procedure, one does not increase water repellence.

The lengthening of the aliphatic chain has been found to lead to an increase in the Van der Waals cohesive forces between adjacent chains and thus to a closer packing of the molecules.[29]

The better shielding of the hydrophilic carboxyl groups from the water, obtained with long chain compounds is also contributing to an increase in contact angle against water.

Quantitative work has been done[29] to relate contact angle with structure and amount of soil on a substrate metal. It is assumed that the total work of adhesion of an adsorbed monolayer to a substrate surface is composed of contributions from exposed organic groups and radicals.

For a long-chain polar molecule the work of adhesion can be written mathematically as follows:

$$W_A = W_{CH_3} + W_{CH_2} + W_P + W_S \qquad (I)$$

where: W_A = work of adhesion
W_{CH_3} = contribution to W_A by all exposed methyl groups
W_{CH_2} = contribution of methylene groups
W_P = contribution of polar groups
W_S = contribution by exposed substrate

A "packing fraction" X is defined as the ratio of number (n) of molecules adsorbed per unit area to the maximum number (n_1) of adsorbable molecules per unit area.

$$\text{Thus } X = \frac{n}{n_1} \qquad (II)$$

For n = o we have x = o no adsorption
For n = 1 we have x = 1 maximum adsorption
Intermediate soiling will be given by o × 1

By expressing the "work of adhesion" in terms of contact angle, free energy decrease of the substrate solid on immersion, and surface tension of the liquid, the following expression can be derived:

$$X = \frac{\cos \Theta_x - \cos \Theta_o}{\cos \Theta_I - \cos \Theta_o} \qquad (III)$$

where: x = "packing fraction"
Θ_o = contact angle for x = o
Θ_I = contact angle when x = 1
Θ_x = contact angle with X "packing fraction"

Equation (III) is valid for all hydrophobic surface films obeying the "patch-like" distribution pattern.

Noting that

Θ = o for x = o
Θ_x = 90° for x = 1

Equation (III) reduces to $X = 1 - \cos \Theta_x$ (IV)

Equation (IV) provides the possibility for quantitative evaluation of amount of grease soil on a substrate metal from contact angle measurements.

In the course of this work, experimental evidence has been obtained showing that pitting is another undesirable consequence of greasy impurities which favor hydrogen bubble attachment. A literature research on the subject was consequently in order. It became apparent that the problem of pitting has not been sufficiently elucidated, particularly as to its causes. The situation is well reflected by a statement of the late Professor Colin G. Fink of Columbia[13] made in a discussion:

"In reference to nickel deposits, we are always confronted with the problem of eliminating those points on the cathode at which hydrogen will anchor. If there were only some way we could eliminate these anchoring points! Although not all pits are due to hydrogen, probably 80 per cent of them are."

Cymboliste and Salauze[9] have investigated the problem, and concluded that pitting is a consequence of gas bubble attachment. Colloidal and suspended matter is also said to be a possible cause of pitting, since such particles will attach themselves to the cathode and metal with electrodeposit on top of them, providing they are conductive.

McNaughtan, Gardam and Hammond[28] have advanced a somewhat different theory to account for gas bubble adherence. Thus it is stated that the phenomenon is mainly due to inclusion of basic nickel products, formed during electrolysis.

Hothersall and Hammond[13] have supported a different conception as to the origin of pitting. They note that "bubbles form at the site of inclusions or other surface imperfections which would cause pores irrespective of bubble formation. The primary cause of porosity would then be the imperfection and not bubbles."

Some workers support the view that bubbles are forming on cathodic locations of low hydrogen overvoltage.[12] "Bubble formation may commence with deposition if the cathode is made of or coated with a metal of low hydrogen overvoltage on the cathode surface, for example, rough areas or inclusions."

A similar mechanism is suggested by Burns and Bradley:[8] "Hydrogen evolution may be affected by inclusions or other inhomogeneities on the cathode surface, finely divided solid matter which may settle on the cathode, inorganic or organic impurities."

EXPERIMENTAL PROCEDURE

Copper specimens used throughout this work consisted of 2 by 3 by 1/24 inches electrolytic, soft copper. They were mechanically mirror polished,* representing a surface roughness of 4 and 2 rms micro-inches in two perpendicular directions of the sample, as recorded on a profilometer.** The specimen was soaked in alkaline cleaner[15] for 15 minutes followed by rinse in running tap water, HCl dip and tap water rinse. It then underwent the following treatment.

1. Electrolytic polishing.

This procedure was devised to remove smeared metal and abrasive inclusions which may result from mechanical polishing. The electrolyte consisted of a 65 weight per cent aqueous solution of orthophosphoric acid (193 volumes of commercial acid and 100 volumes of water). Optimum current density was determined by plotting voltage drop across the cell vs. current density, thus locating the "plateau" of the curve

* Courtesy Lea Manufacturing Company, Waterbury, Connecticut.
** Courtesy ME Dept., Columbia University. The instrument was Model DAC, diamond stylus 0.0005 in. tip radius, Physicists Research Company, Ann Arbor, Michigan.

where polishing is reported to be optimum.[15] Typical polishing conditions were 8 amp/dm², voltage drop across the cell 2.8–3.0 and room temperature. Electrodes were suspended vertically 6 cm apart. Both anode and cathode were copper, their dimensions being identical. Polishing action was maintained during 4–5 minutes, after which the sample was withdrawn from the bath and dipped in a 5 per cent aqueous solution of orthophosphoric acid to remove insoluble anodic products formed during electrolysis.

Attempts to provide "atomizer clean" samples by electropolishing were unsuccessful due to organic impurities in the orthophosphoric acid, though the latter was cp. grade. As a result, subsequent cleaning was resorted to.

2. Cleaning of specimens.

The same cleaning procedure was employed as developed by Linford and Feder[17] and later used by Linford and Venkateswarlu.[22]

Surface roughness measurements of the cleaned sample indicated 5 rms michro-inches, a roughening of 2 rms michro-inches due to etching.

3. Soiling procedures.

Three different methods were used to apply the stearic acid film to the substrate plate. Following is their brief outline.

a. Film deposition by the Langmuir-Blodgett technique.[5]

Keeping the "atomizer clean" specimen completely immersed, a monolayer of stearic acid is spread in the form of a benzene solution of 4 g/l on the surface of a bath contained in a brass tray. The bath was prepared from a solution of $BaCl_2$ or $BaCO_3$ 10^{-4} M and buffered to the appropriate *p*H with a solution of $NaHCO_3$ 2×10^{-4} M. The transfer of the first monolayer from the surface of the solution to the metal plate was obtained during withdrawal of the specimen. The well-known procedure using a "piston oil" (oleic acid) behind a moving thread as a barrier assured transfer at constant pressure.[5] A constant speed motor combined with a system of pulleys afforded regular and slow motion. The sample emerged wet and became water repellent after drying. By lowering the monolayer-covered sample into the tray and then raising it, two additional monolayers are added, and the specimen emerges dry. A large number of monolayers can thus be built up, by repeated up and down trips of the sample.[5]

Running conditions in the course of this work can be summarized as follows:

*p*H of tray solution	= 6.3
Moving speed of sample	= 1 inch/minute
Time of immersion of sample while monolayer is spread	= 2–3 minutes

b. Devaux method.

This method has been successfully used by Linford and Saubestre[19] in their work on cleanliness tests. It consists of depositing a known amount of soil on a given area, the quantity of soil retained by the sample being expressed in g/cm². This is achieved by dissolving the fatty acid in a volatile solvent, and applying a certain number of drops of known volume on a scribed area of the panel. For the convenience of the adhesion test, the portion of the panel which received the stearic acid-benzene solution was a 2 by 3 cm strip, terminated at the two ends by half circles.

A curved-tip glass rod was used to promote even distribution of the soil solution. This method is said to provide the specimen with a non-oriented film which may orient itself on standing.

c. Method described by Harkins.[12]

The atomizer clean sample, still wet, is flooded with 2/1000 M benzene solution of stearic acid, then rubbed thoroughly with a clean tissue. Such procedure is reported to remove all but one monolayer of stearic acid.

A copper plate treated in the above manner displays a high water repellence, causing a water drop to roll off, a condition obtained only with three monolayers applied by the Blodgett technique. It is therefore safe to assume that the amount of grease retained by the sample in this method is more than a monolayer. This assumption is substantiated by very low adhesion of the subsequent nickel plate, as shown further.

TABLE I
TABULATION OF ADHESION RESULTS

Method of film deposition	Number of Monolayers	$\frac{g}{cm^2}$ Stearic Acid retained by sample	Force (lb) required to detach 1/2 in. wide strip	Remarks
Harkins:[12] Wet specimen flooded with stearic acid 2/1000 M then thoroughly rubbed with clean tissue.	Unknown	Unknown	Negligible. Coating easily detachable by hand; does not come off spontaneously.	Water drop rolls off the soiled plate.
Langmuir-Blodgett: Tray solution prepared from $BaCO_3$ 10^{-4} M, buffered with $NaHCO_3$ to *p*H = 6.3	3	6.6×10^{-7}	10–13	Water drop rolls off.
	1	2.2×10^{-7}	150	—
			200	—
Langmuir-Blodgett: Tray solution prepared from $BaCl_2$, 10^{-4} M, buffered with $NaHCO_3$ to *p*H = 6.3	1	2.2×10^{-7}	360	—
			405	—
Devaux	1	2.2×10^{-7}	380	—
	2/3	1.46×10^{-7}	420	Basis copper torn.
			415	Basis copper torn.

4. Nickel plating and adhesion testing.

The sample, after being soiled by one of the above procedures, was plated with nickel and the adhesion determined by the methods developed by Linford and Venkateswarlu.[23]

RESULTS AND DISCUSSION

The low adhesion of a nickel coating deposited onto 3 monolayers of stearic acid, as shown in Table I, is in agreement with a theory[27] of adhesion, according to which the interatomic forces responsible for metallic bonding fall off to very low values at distances greater than 50 Å. If it is assumed that the chains of stearic acid molecules are rigidly parallel and perpendicularly oriented onto the substrate specimen, then the total thickness of a film of 3 monolayers is 69 Å.

The foregoing results obtained with 3 monolayers support the assumption of deposition on top of the film, rather than plating under it. The obtained adhesion value would thus be due to residual atomic forces at the distance of 69 Å.

The substantial increase in adhesion resulting with coatings deposited onto 1 monolayer as compared with 3 monolayers should be attributed to the decrease in the distance separating superficial atoms of the base metal and deposited nickel atoms, which now is only 23 Å. In the stearic acid film applied by the Langmuir-Blodgett procedure under a constant pressure of 30 dynes/cm the area per molecule is 20 Å^2. Now assuming close packing of the molecules in the film, intermolecular separation becomes 4.8 Å^2 which eliminates the possibility for penetration of hydrated Nickel ions inside the film, since the hydrated ion is larger than this. It can be assumed that a hydrated nickel ion would have two layers of water molecules surrounding the central metal ion.* Thus it is reasonable to assume a diameter of the order of 6 Å.

Occlusion into the film of benzene molecules from the spreading solution and their expulsion during the initial period of electrolysis could be the only source of film injury, allowing direct anchoring to occur. However, under the pressure of 30 dynes/cm their expulsion before the film is applied to the specimen is highly probable.

There is no apparent explanation to account for the difference in adhesion values between monolayers deposited by the Langmuir-Blodgett procedure from a substrate bath composed of $BaCO_3$ + $NaHCO_3$ and one containing $BaCl_2$ + $NaHCO_3$. Increased adsorption in the former bath can only be put forward with reserve.

Good agreement between results with monolayers applied by the Devaux method and the Langmuir-Blodgett technique using the $BaCl_2$ – $NaHCO_3$ bath permits one to conclude that the two types of film act similarly on electrodeposits.

From Table I it can be seen that so long as the amount of stearic acid is less than 0.5 monolayers, adhesion will not be affected. Since 0.5 monolayers is the limit of sensitivity of the water break test[21] it can be seen that the sample which will pass a properly conducted water break test will yield satisfactory adhesion.

Nickel plating on specimens soiled by the Devaux method provided a convenient tool for quantitative evaluation of the effect of grease on pitting. Indeed, the same cathodic surface can be partitioned into two regions of well defined boundaries: one, thoroughly cleaned and tested, another coated with a fatty acid film of predetermined concentration. It is thus possible to study simultaneously the behavior of the two regions, eliminating a number of variables which are mentioned in the literature as possible causes of pitting, such as surface imperfection, adherence of basic nickel products to the cathode, etc.

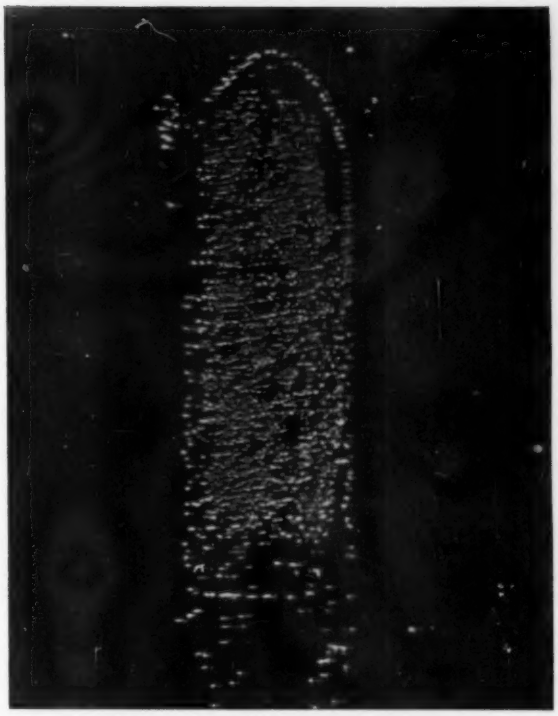

Fig. 1. Soiled area coated with 0.8 monolayers of stearic acid 2 X area magnification.

In this regard Figs. 1, 2, and 3 are quite revealing. The central area of Fig. 1 shows the bubble density when 0.8

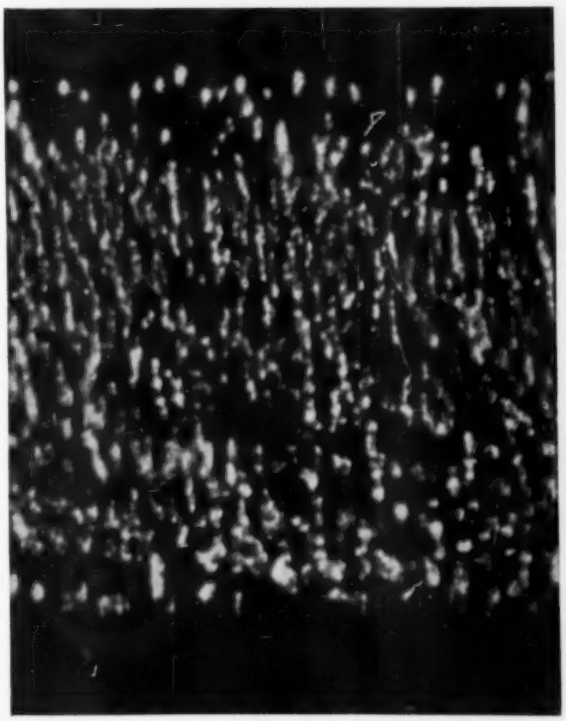

Fig. 2. Same as Fig. 1, except 28 X area magnification.

* Private Communication from J. O'M. Bockris.

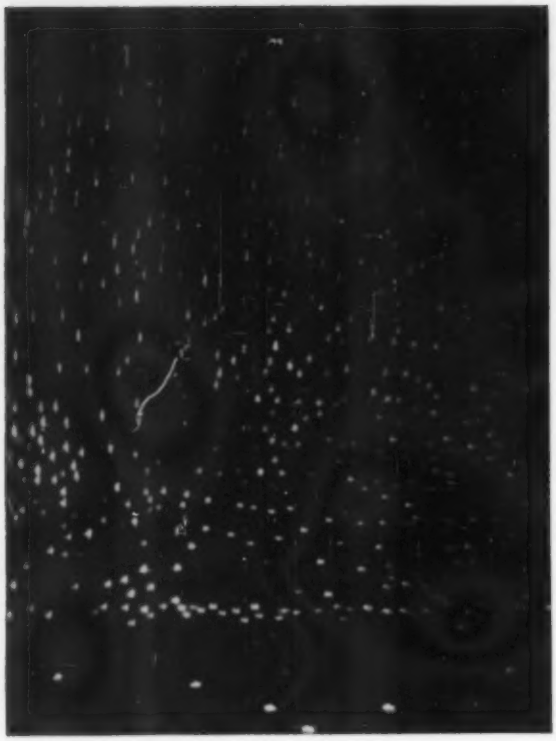

Fig. 3. Soiled area coated with 0.2 monolayers of stearic acid, 28 X area magnification.

monolayers of stearic acid has been applied to an atomizer clean copper surface. Fig. 2 is an enlargement of a portion of Fig. 1. Fig. 3 shows the bubble density with 0.2 monolayer of stearic acid at the same magnification as Fig. 2.

The electrodes were photographed while plating was in progress. The areas which received the stearic acid films exhibit a dense bubble population. On emergence the locations of the bubbles are marked with pits, which are well known causes of "galvanic" failure of the electroplate on atmospheric exposure.

The few bubbles present in the "atomizer clean" area of the specimen prove that a pit-free nickel coating requires a far greater criterion of cleanliness than adhesion. Even very minute traces of organic impurities on the cathode may result in rejects due to pitting, yet adhesion may be satisfactory. The so called "non pitters" so widely used in the industry are organic substances which remedy the difficulty to a certain degree by lowering the surface tension of the liquid.

The observation that bubble density appears to be dependent on the quantity of stearic acid present on a surface appears to be capable of being developed into a very sensitive test for cleanliness. Further, it is very likely that this same phenomenon will be useful in studying the efficiency of "non pitters." The possibility still exists that other than hydrophobic soils may cause this phenomenon. Actually there are two separate phases of the phenomenon; the first is the generation of the bubbles and the second is the adherence of the bubble. Our experimentation so far has been limited to the case of stearic acid on copper basis metal. This phenomenon should be further studied with other systems.

Some experiments were then required to elucidate these phenomena. In the first place, it was felt that current efficiency measurements of nickel deposition on clean and soiled cathodes might lead to some clarification.

A copper coulometer was connected in series with the Watts nickel bath, with a platinum cathode between two copper anodes. The coulometer bath had the following composition:

$CuSO_4 \cdot 5\ H_2O$	125 g/l
H_2SO_4	50 g/l
Ethyl alcohol	50 g/l

Cathodic current density in the coulometer was 0.01 amp/cm^2. Nickel plating was conducted as described previously. Electrolysis was maintained during one hour resulting in a deposit approximately 0.0005 in. thick. Current efficiency was calculated by determining gravimetrically the weight of the nickel deposit and dividing it by the theoretical weight of nickel as calculated on the basis of total number of coulombs passed through the circuit. Two runs were performed:

1. "Atomizer clean" copper electrode, yielding a current efficiency of: 99.5 per cent.
2. Specimen coated with one monolayer stearic acid deposited by the Langmuir-Blodgett technique from substrate solution containing $BaCl_2$ + $NaHCO_3$ of *p*H = 6.3, resulting in current efficiency of: 99.0 per cent.

Since these results indicated that there were no significant differences between current efficiencies of clean and soiled cathodes when plates 0.0005 in. thick were applied, it was felt necessary to justify the relatively rapid growth of hydrogen bubbles at the beginning of electrolysis. In view of the fact that only a few minutes were necessary to develop this bubble pattern, it would have been expected that current efficiency of the soiled cathode should have been considerably lower than current efficiency on the clean cathode.

The next experiment involved tracing of time-potential curves at constant current for the initial phase of electrolysis, using an "Offner Electronic" Dynograph.* This Dynograph has provision for various chart speeds. In this experiment the chart was running at 100 mm/sec. Further, the characteristics of the Dynograph are such that a full scale deflection is obtained in 1/100 of a second, thus making it possible to trace time-potential curves during the initial charging period of the double layer.

The 1.7 by 1.7 in. copper specimens received the previously described[17] hydrogenperoxide treatment. The nickel anode of identical dimensions was 4 cm apart from the cathode. Electrolysis was conducted in the high *p*H Watts bath at a temperature of 43–44C. Current density was 9.3 asf.

The recorder was set in motion immediately after immersion of the electrodes. The current was then turned on and the recorder permitted to run for approximately two seconds. Fig. 3 shows the potential-time relationship as read from the recorder chart.

The two curves can be divided into three distinctive portions:

1. The time-potential relation is a linear one and the double layer of the cathode behaves like a condenser. No ions are being discharged during this period. The ions arrive at but cannot cross the solution side of the double layer, until the potential has reached a certain value.

2. Potential reaches a maximum at which ion discharge becomes possible.

3. Potential levels off to become practically constant with time.

* Recording instrument was Dynograph, Offner Electronic Inc., Chicago 25, Illinois.

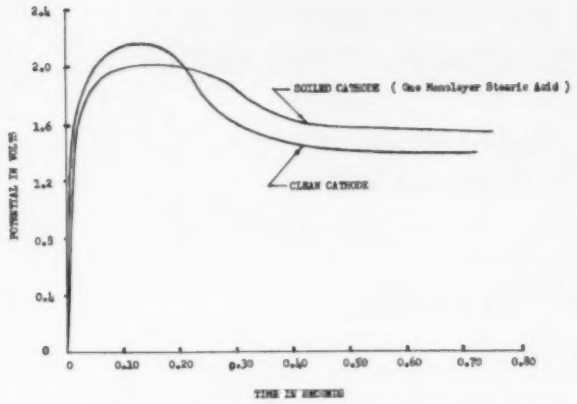

Fig. 4. Potential vs time relationship for nickel plating cells showing effect of dirty cathode.

Comparison of the two diagrams of Fig. 4 affords the following observations:

a. Discharge potential (corresponding to maximum of plot) is lowered for the specimen coated with the stearic acid monolayer. It means that discharge of hydrogen ions has been facilitated, and will be the primary reaction during the first fractions of second of electrolysis.

b. The leveling off of the potential-time curve representing the soiled cathode occurs at a higher voltage as compared to the clean cathode. Indeed, spots at which hydrogen is evolved will become insulated from the electrolyte, and the cathode now operates at higher current density, resulting in increased over-potential of Ni deposition.

CONCLUSIONS

1. Adhesion of nickel deposits on copper will be satisfactory if specimen passes a correctly performed water break test.
2. The presence of even small traces of organic contaminants on surfaces to be nickel plated will result in pitting due to hydrogen bubble attachment. The phenomenon is sensitive to quantities equivalent to <0.05 of a monolayer.
3. The presence of organic contaminants on the cathode will result in preferential discharge of hydrogen during the first fractions of second of nickel plating.

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PROGRESS TOWARD THE DEVELOPMENT OF A NONEMBRITTLING CADMIUM ELECTROPLATING PROCESS

II. Use of Aliphatic Amino Acids as Complexing Agents in Aqueous Baths

Second in a Series of Papers

by P. N. VLANNES and S. W. STRAUSS*

Non-cyanide aqueous baths containing β-alanine or an α-amino acid (glycine, n-butryic, isobutyric, n-caproic, or isocaproic) were investigated over a wide pH range for their characteristics in plating cadmium on ultra-high-strength steel. Plating evaluation included Hull-cell and throwing-power tests, and embrittling characteristics were determined by the delayed-fracture test using notched bars in tension. The results of delayed-fracture tests indicated that plating from an ammoniacal cadmium bath (adjusted to the optimum pH range) containing salts of amino acids results in markedly lower hydrogen embrittlement than plating from the standard cyanide bath.

INTRODUCTION

IN RECENT YEARS there has been a mounting incidence of service failures in which electroplated high-strength steel articles fail by a delayed brittle fracture. It has long been known that such delayed fracture is caused by hydrogen introduced into the steel during the electroplating process, added, in some instances, to hydrogen left over from steelmaking or introduced during pickling or cathodic cleaning. It has been found that baking the plated steel has a beneficial effect if the stress is low or if the steel is not heat-treated to a too-high strength level. But it has been shown that if the stress is concentrated, as in a notched tensile bar, baking treatments do not satisfactorily remove the susceptibility to

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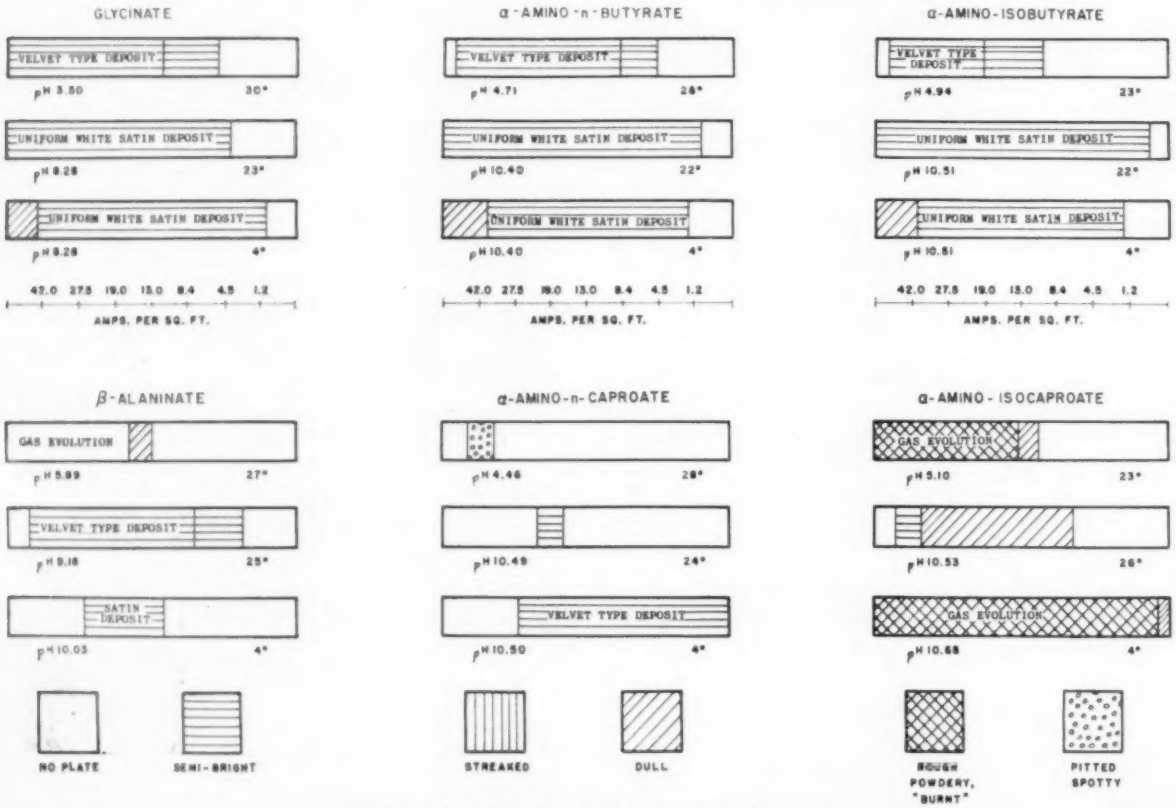


Fig. 1. Hull-cell data for the aliphatic amino-acid solutions

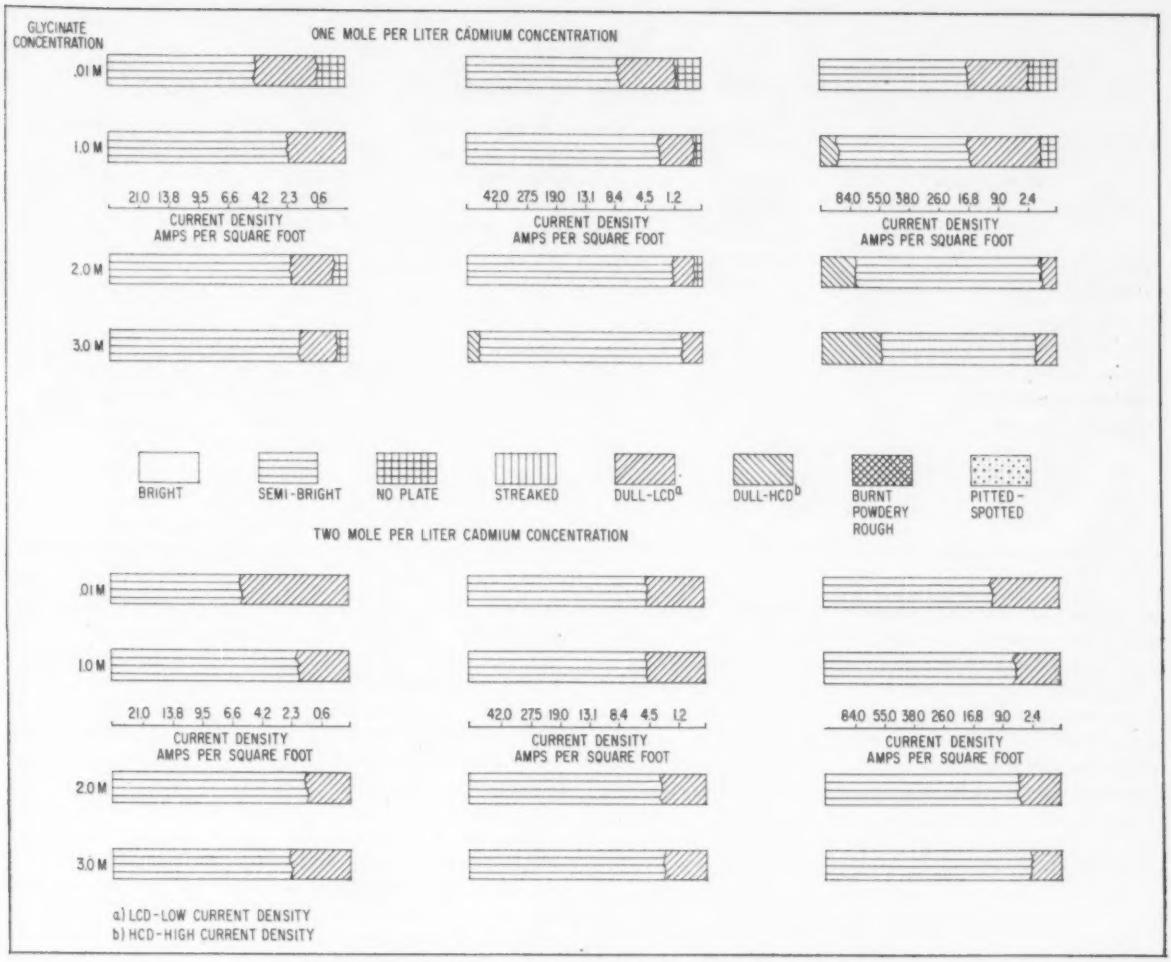

GLYCINATE CONCENTRATION
ONE MOLE PER LITER CADMIUM CONCENTRATION
.01 M
1.0 M
21.0 13.8 9.5 6.6 4.2 2.3 0.6
CURRENT DENSITY AMPS PER SQUARE FOOT
42.0 27.5 19.0 13.1 8.4 4.5 1.2
CURRENT DENSITY AMPS PER SQUARE FOOT
84.0 55.0 38.0 26.0 16.8 9.0 2.4
CURRENT DENSITY AMPS PER SQUARE FOOT
2.0 M
3.0 M
BRIGHT
SEMI-BRIGHT
NO PLATE
STREAKED
DULL-LCD[a]
DULL-HCD[b]
BURNT POWDERY ROUGH
PITTED - SPOTTED
TWO MOLE PER LITER CADMIUM CONCENTRATION
.01 M
1.0 M
21.0 13.8 9.5 6.6 4.2 2.3 0.6
CURRENT DENSITY AMPS PER SQUARE FOOT
42.0 27.5 19.0 13.1 8.4 4.5 1.2
CURRENT DENSITY AMPS PER SQUARE FOOT
84.0 55.0 38.0 26.0 16.8 9.0 2.4
CURRENT DENSITY AMPS PER SQUARE FOOT
2.0 M
3.0 M
a) LCD - LOW CURRENT DENSITY
b) HCD - HIGH CURRENT DENSITY

Fig. 2. Hull-cell data for changes in the glycinate and cadmium concentrations

delayed fracture of ultra-high-strength steel cadmium plated from the cyanide bath.[1]

In an earlier report in this series, the degree of embrittlement of steel electroplated with cadmium was assessed by comparing the reduction in area of specially contoured specimens which had been pulled to fracture in a tensile machine.[2] The results of these tests indicated promising behavior of two types of aqueous baths, one containing the ammonium salt of an aliphatic amino acid in an ammoniacal cadmium sulfate solution, and the other being an aqueous triethanolamine-cadmium sulfate solution. The present paper describes more detailed studies of cadmium-amino-acid baths in which the embrittlement is assessed by the more sensitive delayed-fracture test. It is intended to offer similar accounts of experiments with aqueous triethanolamine baths, with some non-aqueous baths, and an alcoholic solution of a cadmium salt, in the near future.

SELECTION OF COMPLEXING AGENTS

In order to formulate cadmium plating solutions and to be free to work in the alkaline range, it is necessary to add a complexing agent to prevent precipitation of cadmium hydroxide; use of ammonium hydroxide to solubilize the cadmium as the tetra-ammonia complex did not yield satisfactory plating solutions. For a preliminary evaluation of the numerous compounds which could conceivably act as suitable complexing agents, a screening process was adopted in which plating

Table I

COMPOSITION OF AMINO-ACID BATHS

Compound	Weight of Amino Acid (g/l)	Weight of $3CdSO_4 \cdot 8H_2O$ (g/l)	Conc. NH_4OH (ml/l)
Glycine	170	305	350
β-Alanine	320	465	500
α-amino-n-butyric acid	150	190	350
α-amino-isobutyric acid	150	190	350
α-amino-n-caproic acid	5	17.5	250
α-amino-isocaproic acid	10	37	375

TABLE II

THROWING POWER USING MODIFIED STERNFELD-LOWENHEIM TYPE CELL

Compound	Current Density (amp/sq ft)	Average Weight in mg of Deposit on Far Cathode Set to Base of 30 mg on Near Cathode	Ratio of Weight Increase of Near Over Far Cathode	Throwing Power by Field Formula (per cent)
Cyanide	25	7.70	3.9	15.9
Glycinate	15	1.32	22.7	−68.9
β-alaninate	15	1.43	21.0	−66.7
α-amino-n-butyrate	15	1.77	16.9	−59.8
α-amino-isobutyrate	15	1.53	19.6	−64.6
α-amino-n-caproate	5	—	>>28.7	<<−74.8
α-amino-isocaproate	5	—	>>28.7	<<−74.8

Plating time—15 minutes
Cathode distance—2 inches and 10 inches from anode
Distance ratio—5:1

was attempted on a strip cathode in a beaker containing reagent-grade cadmium sulfate plus the complexing agent under consideration. The major criterion for acceptance as a complexing agent for further study was the ability to give an adherent deposit. From a large and heterogeneous assortment of possible complexing agents such as mono- and dicarboxylic acids, aldehydes, amines, and hydroxy acids, the following were among the ones that appeared from the results of the screening tests to justify further study: glycine, β-alanine, α-amino-n-butyric acid, α-amino-isobutyric acid, α-amino-n-caproic acid, and α-amino-isocaproic acid.

PLATING EVALUATION

Current-Density Characteristics

Hull-cell tests were made by passing a current of one ampere for ten minutes through a plating solution contained in a 267-ml cell with a cadmium anode and steel cathode, according to the method of Ref. 3. Bath compositions are given in Table I and current density characteristics in Figs. 1 and 2. Fig. 1 shows that (a) the butyrates and glycinate solutions gave satin deposits over a wide range of current densities, (b) the β-alaninate gave somewhat duller deposits over almost as wide a current density range, (c) the caproates gave semibright deposits over only a narrow current density range, (d) raising the *p*H increases the plating latitude of the solutions, and (e) with the exception of the n-caproate, comparatively little advantage in plating latitude is gained by going to low temperature. The data in Fig. 2 which show the effect upon plating characteristics produced by the variation of the concentration of cadmium and of glycine indicate that (a) for a given concentration of glycine, an increase in the cadmium concentration does not cause a significant change in plating latitude, and (b) for a given concentration of cadmium, an increase in the concentration of glycine increases the plating latitude and the appearance of the deposit toward a more refined grain structure, but without any significant change beyond a molar ratio of 2 glycine to 1 cadmium. In general, similar results were obtained for the other amino-acid solutions. In the case of the caproates, the amino-acid concentration could not be varied over wide limits due to the low solubility of these amino acids.

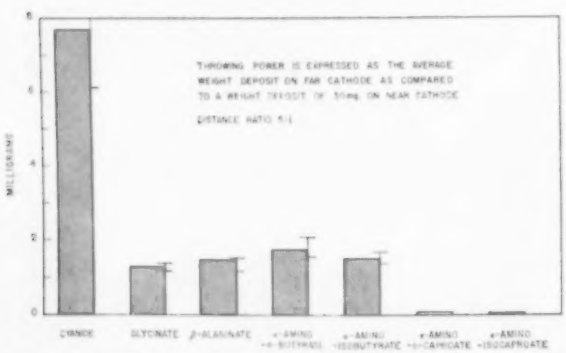

THROWING POWER IS EXPRESSED AS THE AVERAGE WEIGHT DEPOSIT ON FAR CATHODE AS COMPARED TO A WEIGHT DEPOSIT OF 30mg. ON NEAR CATHODE
DISTANCE RATIO 5:1
MILLIGRAMS
CYANIDE
GLYCINATE
β-ALANINATE

Fig. 3. Throwing power with far cathode shielded

Determination of Throwing Power

Ammoniated cadmium aminate solutions, *p*H 7–10, whose cadmium concentrations were the same as those in the Hull-cell experiments, were used. Measurements were made by

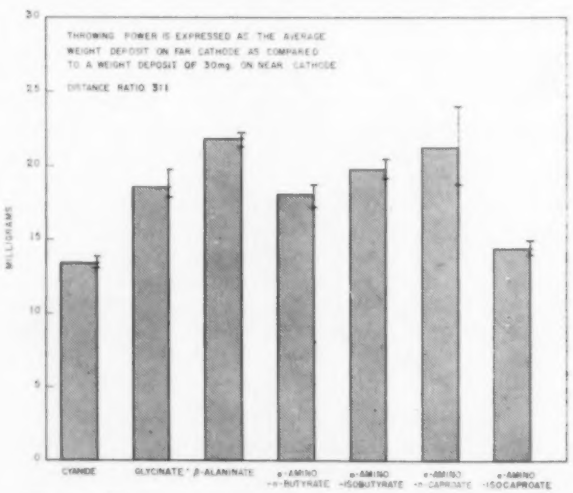

THROWING POWER IS EXPRESSED AS THE AVERAGE WEIGHT DEPOSIT ON FAR CATHODE AS COMPARED TO A WEIGHT DEPOSIT OF 30mg. ON NEAR CATHODE
DISTANCE RATIO 3:1
MILLIGRAMS
CYANIDE
GLYCINATE
β-ALANINATE

Fig. 4. Throwing power as determined in a modified Haring-Blum cell.

two different methods and at two cathode-anode distance ratios.

The first method was an adaptation of the Sternfeld-type cell, but with a horizontal cylindrical glass container and following the general procedure of Lowenheim.[4] Experimental conditions are given in Table II. Deposits on two cathodes in which one shielded the other were weighed, and the throwing power was expressed as the weight of deposit on the far cathode for a constant weight (30 milligrams) deposited on the near cathode. In the second method, a modified Haring-Blum cell was used with conditions as given in Table III, and the throwing power was expressed in the same manner as in the first method.[5]

The data in Figs. 3 and 4, in which the throwing power of the amino-acid baths are compared with that of the standard cyanide bath, show that regardless of which of the two methods was used, there was little distinction between the butyrates, the glycinate, and the β-alaninate baths. The data also indicate that the values of throwing powers relative to that of the cyanide bath were dependent in part at least on whether or not the far cathode was shielded. In the Sternfeld-type cell, in which the far cathode was shieleded, the caproates had poorer throwing power than the other amino-acid baths, and all the amino-acid baths had poorer throwing power than the cyanide bath. The results obtained in the Haring-Blum cell, in which the far cathode was not shielded, indicate that the throwing powers of all the amino-acid baths studied were comparable to that of the cyanide bath. The data in Fig. 5 suggest that the throwing powers of the amino-acid baths are not likely to be affected to any appreciable extent by variation in the cadmium concentration, at least within wide limits.

BARREL PLATING

All the amino-acid solutions containing 1M cadmium were evaluated for plating behavior in a laboratory-scale horizontal-barrel unit. The charges consisted of miscellaneous hardware to provide a variety of contours. The results indicate that without exception the throwing powers of these baths in barrel plating, as judged from coverage of thread roots, is superior to that of tank plating. The plate appearance, a satin-like deposit, is also better on the barrel-plated articles than on tank-plated articles from the same bath, perhaps due in part to burnishing by the tumbling action.

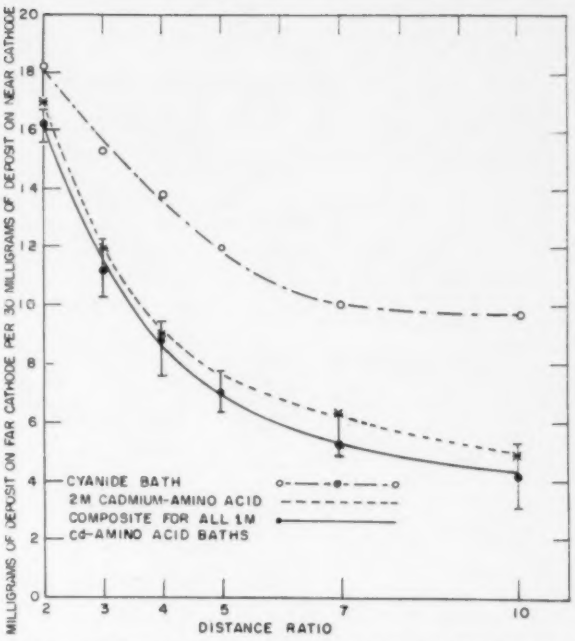


Fig. 5. Throwing-power evaluation of 1M and 2M cadmium-amino-acid baths

EMBRITTLEMENT CHARACTERISTICS

The delayed-fracture test adopted was the cylindrical notched bar under sustained load.[6] Fig. 6 shows the specimen, and Fig. 7 shows the method of loading. The substrate was AISI 4340 steel heat-treated to approximately 285,000 psi ultimate (*smooth*) tensile strength, and the load applied on the plated specimen was 75 per cent of the notch tensile strength of the unplated bar. The specimens were sand-blasted rather than pickled before being plated, to eliminate the embrittlement known to be caused by conventional pickling alone. The specimens were plated to a thickness on the barrel of approximately 0.0007 in. from amino-acid baths, whose compositions are given in Table IV. Criteria for acceptable plating of the tensile bar included coverage by cadmium of the root of the notch, as judged by microscopic ex-

TABLE III

THROWING POWER USING MODIFIED HARING-BLUM CELL

Compound	Current Density (amp/sq ft)	Average Weight in mg of Deposit on Far Cathode Set to Base of 30 mg on Near Cathode	Ratio of Weight Increase of Near Over Far Cathode	Throwing Power by Field Formula (per cent)
Cyanide	25	13.4	2.24	23.5
Glycinate	15	18.5	1.62	52.7
β-alaninate	15	21.8	1.38	68.1
α-amino-n-butyrate	15	18.0	1.67	49.8
α-amino-isobutyrate	15	19.7	1.52	58.7
α-amino-n-caproate	3	21.2	1.42	65.3
α-amino-isocaproate	3	14.3	2.10	29.0

Plating time—15 minutes
Distance ratio—3:1

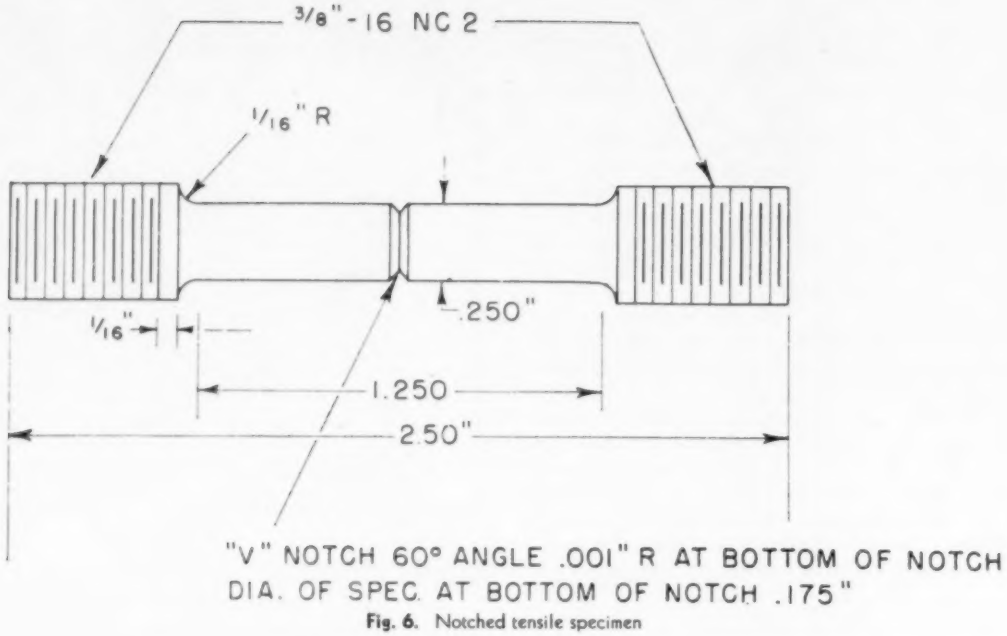
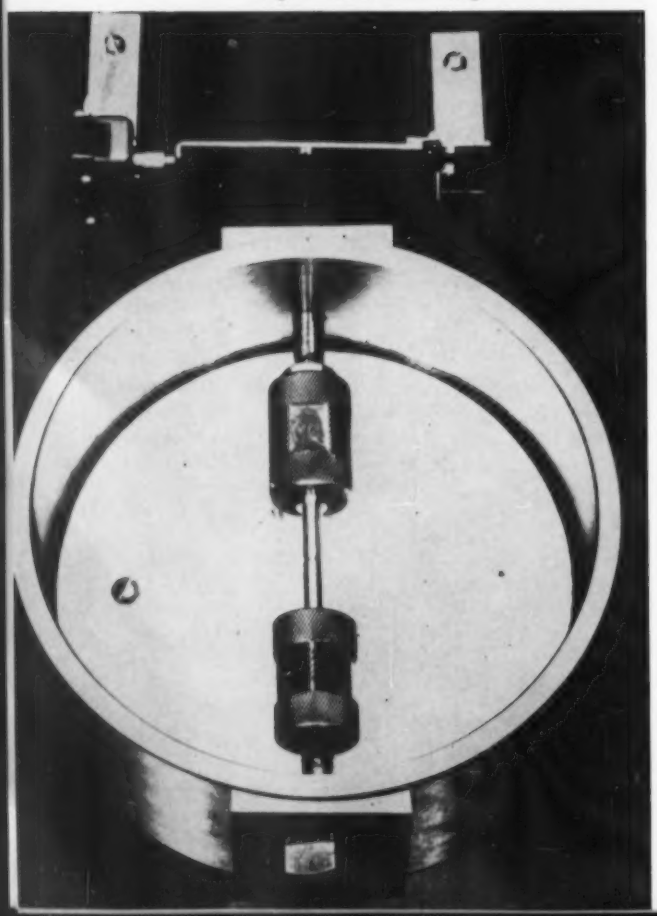


Fig. 6. Notched tensile specimen

amination; all specimens were loaded immediately after being plated. Subsequent to completion of the delayed-fracture test, a metallographic section of the notched tensile bar was examined microscopically to ascertain the extent of coverage of the root of the notch.

Fig. 7. Elastic tension ring



The delayed-fracture test is most realistically viewed as one bordering on the "go/no-go" type. Accordingly, the specimens from the delayed-fracture tests have been arbitrarily divided into two categories, depending on whether or not the specimens survived 100 hours of testing. Those specimens that remained intact after 100 hours were considered essentially unembrittled. For those specimens that broke in less than 100 hours, the average survival time was compared with that for specimens plated from the cyanide bath. The delayed-fracture data are given in Table IV.

However measured, data on susceptibility to delayed fracture show wide scatter, and those tabulated are not exceptional in this respect. The data in Table IV do, however, indicate clearly that the amino-acid baths are less embrittling than the cyanide bath.

CONCLUSIONS

1. The plating characteristics of aqueous cadmium baths containing six aliphatic mono-amino acids have been investigated. Satisfactory plates were obtained from ammoniacal solutions of these baths, the baths being operated at near saturation with respect to the amino-acid and over a *p*H range of 7 to 10.

2. Plating characteristics for these baths whose cadmium concentrations were set at 1M and 2M and whose amino-acid concentrations were varied from 0.01M to 4M, or to the limit of maximum solubility of the amino-acid, showed that for a given concentration of cadmium, an increase in amino-acid concentration increased the plating latitude and improved the appearance of the deposit, but without any significant change beyond a molar ratio of 2 amino-acid to 1 cadmium. However, an increase in cadmium concentration did not cause a significant variation in plating latitude.

3. Throwing-power results for the six ammoniacal cadmium aminate solutions, using two different methods of measure-

TABLE IV

DELAYED-FRACTURE TESTS FOR THE ALIPHATIC AMINO-ACID BATHS*

Bath	Cd M/l	Amino Acid M/l	pH	Bars Broken in Less Than 100 Hours: Average Survival Time (Hr)	Bars Broken in Less Than 100 Hours: Number of Bars	Bars Broken in Less Than 100 Hours: Per cent of Total Number	Bars Unbroken After 100 Hours: Number of Bars	Bars Unbroken After 100 Hours: Per cent of Total Number
Glycinate	1	2	9.73	5	10	34	19	66
	2	2	9.20	—	—	—	2	100
β-alaninate	1	2	9.81	6	3	50	3	50
	2	2	10.62	—	—	—	3	100
α-amino-n-butyrate	1	2	9.52	4	18	47	20	53
	2	2	9.32	—	—	—	3	100
α-amino-isobutyrate	1	2	9.60	6	18	42	11	58
	2	2	9.35	—	—	—	2	100
α-amino-n-caproate	1	0.191	11.12	10	1	33	2	67
	2	0.191	11.05	—	—	—	3	100
α-amino-isocaproate	1	0.152	10.87	2	1	20	4	80
	2	0.152	10.89	—	—	—	1	100
Cyanide Bath†	—	—	—	0.02	9	100	—	—

*Specimens were AISI 4340 steel, heat treated to 285,000 psi ultimate tensile strength. Root Radius 0.001 inch. Stressed at 75 per cent of the notched tensile strength.
†Cyanide Bath—3.5 oz CdO and 17 oz NaCN per gal, 12 oz per 100 gal of R. O. Hull Co.-20XL Brightener.

ment, indicate that the order of merit depends strongly on the method used.

4. All the baths investigated have shown themselves capable of being adapted to barrel-plating conditions, and the throwing powers of these baths in barrel plating, as judged from coverage of thread roots, were found to be superior to that obtained in tank plating.

5. Results of delayed-fracture tests indicate that the amino-acid baths are less embrittling than the cyanide bath, and that the n-butyrate and glycinate are perhaps the best baths, under the conditions of this investigation.

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NOTE—A future paper in this series will include experimental data on hydrogen embrittlement relief at elevated temperatures. Refer also to the first paper in the series, PLATING, *pp. 467 and 468, May 1959.*

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THE NATURE, CAUSE AND EFFECT OF THE POROSITY IN ELECTRODEPOSITS

V. AN EVALUATION OF THE SENSITIVITY OF THE FERROXYL TEST

by FIELDING OGBURN, D. W. ERNST and W. H. ROBERTS*

The importance of a good porosity test prompted a determination of the sensitivity of the ferroxyl test. Strausser's modification of the test was used to determine the porosity of gold coatings on steel. A photographic process determined the porosity of the gold foil obtained by stripping the steel away with acid. A filar micrometer was used to measure the size of the pores present in the gold foil. A comparison of the porosities of the gold foil as determined by both methods gave the following results for pores between 0.05 and 0.5 mil in diameter: (1) Less than 50 per cent of all pores present are detected by the ferroxyl test. (2) Of this number, the larger the pore the more likely it will be detected.

INTRODUCTION

PERHAPS THE BEST KNOWN POROSITY test for nickel coatings on steel is the ferroxyl test. The original procedure was to apply a solution of sodium chloride and potassium ferricyanide to the coating. A blue spot was produced wherever the basis metal was exposed. Several investigators,[1,2,3,4] however, have shown that the reagent attacks the nickel coating and may produce pores. Strausser[3] modified the test to avoid attack of the nickel by eliminating any contact between the ferricyanide and the nickel.

The reliability of the Strausser procedure was tested in the following way. The ferroxyl test was used to detect pores in a gold coating on steel. Subsequently, the steel was dissolved, leaving the isolated coating to be examined microscopically and photographically for pores. A spot-by-spot comparison enabled the estimation of the size of each pore corresponding to a ferroxyl spot.

EXPERIMENTAL WORK

Test specimens were prepared by plating shim steel sheets (3 by 4 inch) (7 by 10 cm) on one side with gold. Coating thicknesses were between 0.3 and 0.5 mil (7 and 12μ).

An area 2 by 3 inch (5 by 7.5 cm) of each specimen was tested with Strausser's modification of the ferroxyl test.[3] Rag bond paper was soaked in a solution of sodium chloride (50 g/l) and white gelatin (50 g/l) and then placed on the gold coating and kept moist with a solution of sodium chloride (50 g/l). After ten minutes the paper was removed, developed in a solution of potassium ferricyanide (10 g/l), rinsed, and dried.

The thin sheet of steel basis metal was dissolved with a mixture of nitric and sulfuric acids, leaving the isolated coating. This step and subsequent handling of the resulting gold foil required very careful manipulation to prevent tearing the gold.

Since gold is not completely inert to a number of reagents, gold foil was left in each reagent for at least 16 hours. There was no evidence of attack, as determined by photographing the porosity before and after the immersion.

TABLE I

CORRELATION OF FERROXYL SPOTS WITH PHOTOGRAPHABLE PORES

Foil	Thickness (mils)	Number of Ferroxyl Spots	Number of Photographable Pores	Ferroxyl Spots which were also Photographable Pores
1	0.35	15	456	15
2	—	10	149	10
3	0.3	194	557	187
4	—	22	142	16
5	0.4	82	378	69
6	0.3	66	189	57
		Total 389	1871	354

* Chemistry Division, National Bureau of Standards, Washington, D. C. Project Director, Research Associate, and Research Assistant respectively.

TABLE II

SENSITIVITY OF FERROXYL TEST AS A FUNCTION OF PORE SIZE

	Pore Diameter (±0.05 mil)				
	0.1	0.2	0.3	0.4	0.5
Pores found microscopically as % of total number of pores found	45	29.1	10.4	9.3	5.8
Pores detected with ferroxyl reagent as % of number of pores of the size indicated	20	64	89	62	80
Pores detected with ferroxyl reagent as % of total number of pores found					47.7%

The porosity of each gold foil was determined by the photographic method described by Ogburn and Benderly[5] The porosity pattern thus obtained was matched with that of the corresponding ferroxyl test paper. Table I summarizes the resulting observations.

Table II gives data obtained in a different manner. A one-inch square was marked off on each of four foils, the location of the square being determined in a purely arbitrary way. All the pores within these squares that could be detected photographically or microscopically were counted. Pore size was determined with a filar micrometer. The spots on the ferroxyl papers were then matched with the pores detected photographically and microscopically. Thus, for each pore it was determined whether or not it had been detected by the ferroxyl test. A total of 86 pores were examined.

DISCUSSION

In Table I it can be seen that the photographable pores are 3 to 30 times more numerous than the ferroxyl spots. The fact that all of the ferroxyl spots do not have corresponding photographable spots may be attributed to the difficulty encountered in counting the photographable pores in darkened areas of the film or to damage to the foil resulting in the closing of small pores. The fact that there are not more ferroxyl spots may be attributed to pore size. It can be seen in row 2 of Table II that as pore size increases from 0.1 to 0.5 mil (2.5 to 12μ), the percentage of pores detected also increases. Pores greater than 0.5 mil (12 μ) were not found in great abundance, but all those that were found gave a positive ferroxyl test.

It is also of interest that the smaller pores are more numerous than the larger pores; 45 per cent of these pores are 0.05 to 0.15 mil (1.2 to 3 μ) in diameter.

The data in Tables I and II, though not extensive, indicates the sensitivity of the ferroxyl test for gold coatings on steel. The sensitivity for nickel coatings should be approximately the same for any given pore size. Because of such factors as surface tension, surface roughness, composition of the steel basis metal, shapes of the pores, and especially galvanic effects, the data for gold cannot be applied directly to nickel without some allowance for these uncertainties.

It is evident that the pore size is an important factor in the sensitivity of the tests. The percentage of the pores detected in a given coating will depend on the sizes of the pores present. Since the latter information is not usually available, this is a major source of error if the test is used to estimate the total porosity. Nickel deposits examined had a distribution of pore sizes similar to that reported here for gold coatings. This is true for pores having a diameter greater than 0.05 mil (1.2 μ) in diameter. With the microscopic and the photographic techniques, we have been unable to detect pores smaller than 0.05 mil (1.2 μ) in diameter and we are not at all sure that we can consistently detect pores in the range of 0.05 to 0.1 mil (1.25 μ to 12 μ).

CONCLUSION

The ferroxyl test as described by Strausser detects less than 50 per cent of the pores in a coating 0.3 to 0.5 mil (7.5 to 12 μ) thick. The actual percentage is a function of pore size, the large pores being detected more consistently than the small pores.

The techniques described can be used to evaluate a chemical porosity test, and it should be possible to modify effectively such tests.

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DECORATIVE HIGH CHLORIDE NICKEL PLATING

by MELVIN TIPPMAN*

The paper discusses the use of high chloride bright nickel plating baths, and summarizes 14 years of the author's experience with the baths.

Metal concentration of 9 to 10 oz gal, nickel chloride concentration of 12 to 25 oz/gal, pH at 4.5 5.0, the use of fluoborate to control calcium from hard water, and a different pre-cleaning system are the main departures from common practice with Watts nickel baths.

Cost factors entering into the selection and use of the bath are outlined. The bath is superior in speed of deposition and anode corrosion, more economical to operate and less costly to equip.

Corrosion resistance and appearance compare with any bright nickel obtained from other solutions for decorative work.

ENTHUSIASM FOR A NEW PROCESS often has the effect of channeling all effort towards the new process. Sometimes older methods that need only a little more understanding and research to make them applicable to the new requirements are neglected. This appears to be the case of decorative bright high chloride nickel baths. Published data on chloride type baths have been rather scarce when compared to the more common bright Watts baths or grey nickel baths. It seems strange that the high chloride bath compositions often reported, and on which so much effort has been placed, are not the baths that have been used for commercial production. Conditions of operation and composition given are not those that produce the best results for decorative work, in fact they often result in poor decorative work.

There has been quite a bit of activity concerning recent changes and innovations in nickel plating. Introduction of high temperature baths, of air agitated baths, baths of high metal content, of double plate systems, new addition agents, with new claims for improved quality and corrosion resistance are all under discussion. It sometimes becomes extremely difficult to select the best system to use, and to find out what real improvement in quality will result.

The use of the high chloride modification of the old Watts bath has been neglected. It performs amazingly well from the standpoint of quality, speed and economy, when conditions of operation are set to make full use of its potential. No blowers, air agitation piping, or special high temperature linings are required. Because of good anode corrosion, salt replenishment is held to a minimum. It is found to be convenient to change metal concentration, chloride to sulfate ratio, *p*H, boric acid and addition agents with a particular end in view. For example, when plating different basis metals, such as copper plated zinc die-cast, it is better to use higher chloride to sulfate ratio to get maximum tolerance to zinc impurity, and to operate at the highest practical *p*H to minimize the solution of zinc.

COMPOSITION

The high chloride nickel bath which has been found very useful for decorative work is one in which the nickel metal is controlled from 7 to 12 oz gal preferably 9 to 10 oz gal, nickel chloride may be from 12 to 30 oz gal with the sulfate making up the balance of the metal. Boric acid is controlled from 5.5 to 7.0 oz gal, preferably at 6.0 oz gal. The *p*H may range from 2 to 5. The temperature range is 125 to 150F. The preferred temperature also depends on the addition agents used and on the ductility and hardness desired. For decorative and best corrosion resistance applications, the bath should be operated close to the following conditions.

Nickel metal	9 to 10 oz/gal
Nickel chloride	12 to 25 oz/gal
Boric acid	6 oz/gal
*p*H	4.0 to 4.8
Cathode current density	45 asf and up
Temperature	145 to 150F

Addition agents should be used according to the suppliers recommendation. Nickel sulfate concentration is set at the required concentration to furnish the balance of the nickel metal.

Cathode current density in the high chloride bath should average upward of 45 asf. The bath may be operated below this point with good results, but full benefit will not be received. In this case solution treatment will be as frequent as for the Watts type baths. Very high current densities have been used, however, we have found no necessity for exceeding an average cathode density of 125 asf, with preference for about 80 to 90 asf. Burning does not readily occur, eliminating any need for burning bars or robbers unless the extra nickel at the high current density areas will cause a problem.

Throwing power is better than a Watts bath. As plating speed is increased throwing power falls off somewhat. Close attention paid to placement of parts on the racks in relation to the anodes usually can more than offset this small change. In the high chloride bath the distribution of plate is better than in the Watts bath at about the same cathode current densities. The speed of plating with the higher current densities in the high chloride bath is such that persons unaccustomed to the bath often overplate. Specification thickness is more readily attained because it is possible to plate in five minutes, the plate usually expected from ten minutes in a Watts type bath.

CHEMICALS

The commercially available nickel salts are satisfactory. Large additions of nickel chloride salts are to be avoided, unless provision is made for the removal of copper impurity usually present. Small additions of the nickel chloride salt cause no trouble.

ANODES

The high chloride nickel bath will give excellent anode corrosion, even of electrolytic and scrap nickel, if the latter is of sufficient purity. Care must be taken to keep sufficient anode area available, when anodes are thin, add new ones and turn the old ones on edge. Anode corrosion is much better and more complete than with any other nickel solution.

PRETREATMENT PRIOR TO NICKEL PLATING

Good pretreatment need not be an involved process. The simpler it is, the less there is to watch. Every step should

*Foreman Plater, Checker Motors Corporation, Kalamazoo, Mich.

be carefully examined, to see that its purpose is accomplished, and that it is really needed.

Pickling or use of strong acid should find its place before finishing, and not be incorporated in the plating treatment. The smuts from pickling are troublesome and hard to rinse, cause clouds, poor adhesion, and brittle deposits.

For plating steel a very acidic nickel strike may be used, then transfer the work directly to the plating tank. The pretreatment at Checker is: soak clean, to remove lubricants and phosphate coating, water rinse, cathodic clean, for nickel over nickel, anodic clean for steel, water rinse, water rinse, nickel strike, nickel plate.

The *p*H of the nickel bath will not be affected if the parts are allowed to drain after the strike and the bath volume is not too small in relation to the amount of work being processed. The work should be free of rust before it is put on the cleaning and plating line, and should definitely have no evidence of soil prior to entering the nickel strike. The nickel strike should do no cleaning.

Pay close attention to the backs of the parts. If the backs are not clean the nickel bath will be contaminated, and not operate well in a very short time, or far too much wetting agent will be needed to keep out of trouble. The new soak cleaners that remove rust, heavy draw lubricants, phosphate coatings, all in one stage, are strongly recommended for the first step in cleaning steel that has a phosphate coating.

BATH OPERATION

For plating on aluminum and copper plated zinc, high *p*H operation is recommended. A *p*H of 4.5 to 5.0 gives good results with a minimum of chemical attack. On steel, at Checker Motors, a *p*H range of 4.0 to 4.5 is used. At these *p*H values, roughness will be encountered if good filtration is not used. It is well to note that nothing that belongs in the bath will precipitate at these *p*H values. The precipitated material will cause far less trouble on the filter bed than if allowed to co-deposit with the nickel at lower bath *p*H values, or if allowed to build in the bath. Also at the higher *p*H values less daily brightener is needed, and the plate from the bath is most ductile from *p*H 4.5 to 5.0, providing the bath is free of harmful amounts of metallic and organic impurities. The cathode current densities should be kept toward the higher values, this causes copper and other impurities co-depositing with the nickel to be concentrated in the extreme low current areas, usually on the back sides of the parts where they do no harm. These are then plated out usually as fast as they get into the bath. Within the proper range, operating conditions should be closely held, changes in one variable usually requires a change in another. For example, lower temperatures require lower cathode current densities.

ROUGHNESS AND SKIPS

If troubles with skips or no plate in the recesses are encountered, examine the work going into the bath. Pay particular attention to the backs of the parts, see that they are clean and well prepared, check the nickel coverage, skips or no nickel in low current density areas are most often signs of poor cleaning and progressive bath pollution. One instance of this condition was caused by a poor choice of addition agents. Hull cell tests should always be used to check any suspicion of a possibly contaminated bath.

If intermittent or a constant roughness is a problem, check the makeup water and drag in for calcium. Calcium can cause trouble even in so-called soft water areas, particularly when drag out rinses are used for make-up water. The bath will eventually become supersaturated with calcium sulfate. A slight increase in temperature, a change in *p*H, or even seeding by older crystals, and it will precipitate out until a new saturation equilibrium is obtained. This water-borne roughness can usually be recognized by its irregularity, it will come and go without apparent reason. In extreme cases the needle-like crystals will be seen imbedded in the plate, and may be seen on the anode bags or on the bottom and sides of the tank. Installation of a cation exchanger on the water will eliminate this problem.

Parts falling to the tank bottom and not removed, cause a very severe type of roughness. Remove them at once if possible, or at the latest at the end of the shift.

Because of better anode corrosion and conductivity in the high chloride bath, tighter weave material may be used for anode bags to more effectively prevent roughness from anode particles. Another source of roughness in the high chloride bath is unused rack contacts that burn, causing a precipitate in the bath that settles on the work.

CLOUDY PLATE

In bright plating baths cloudy plate of a hazy white appearance, usually in the middle of the bright band of a Hull cell panel, are quite prevalent. These clouds are caused by organic contamination. They are usually best combatted, not by lowering the *p*H, but rather by finding the source of the contamination and removing it. If the situation is bad enough a batch filtration with activated carbon is necessary. Operation of a lightly contaminated bath by the use of selective adsorption with an activated carbon pack on the filter, about one pound for each thousand gallons, run for periods of more than eight hours, will often permit bright plating without much loss of addition agent or of any production. The wetting agents may have to be built up in concentration, and possibly a slight increase in secondary brightener be made, while continuous carbon filtration is in progress. When the source of contamination is found and removed, quite often bright plating can be maintained by just raising the wetting agent concentration, while the contaminating organic material is slowly plated out, without the need for carbon in the filter.

CORROSION RESISTANCE

Poor corrosion resistance in a plate of over one mil thick nickel, seems to be usually due to inclusions of one form or another. Fine roughness, a contaminated nickel bath, poor basis metal preparation, poor basis metal itself, all contribute to poor corrosion resistance.

Parts examined very carefully and then exposed on our roof, usually failed for the most part, first at some minute defect in the plate, and then in areas of low current density. Salt spray seems to expose the same defects and defective areas. Break down at less than one hundred hours usually indicates low thickness of both nickel and chromium plates.

In general, in our experience, the best corrosion resistance seems to be had under conditions of high *p*H operation, with a smooth plate out of a clear solution, one in good balance and using a medium high current density, with temperatures toward the high side 145 to 150F, and the bath free of harmful amounts of metallic and organic impurities, with the addition agents in good balance and usually below the manufacturers top recommendation.

Ductility and adhesion in our plant is checked by the vigorous use of a ball-peen hammer. The part is struck with the round end to produce a cup, near an edge or hole, indications of failure to draw with the basis metal, cracking, peeling,

crazing or flaking are grounds for rejection. The minimum plate thickness on bumper parts is 0.0015 in. The edges may be more than twice as heavy where the hammer imprint is made.

Work from the high chloride bath operated as closely as possible to the conditions outlined will produce as good a plate as any other bright bath in commercial operation. Under very closely held conditions, some of the dull nickel baths may be able to do somewhat better in corrosion tests. However, these baths are seldom operated with the care and consideration a bright bath must have and often when operated under more adverse conditions, the plate suffers. These dull type baths are not high speed plating baths and need almost double the time to equal the plate thickness easily possible with the high chloride bath and thick nickel plate is always one of the best guarantees of good corrosion protection.

ADVANTAGES OF THE HIGH CHLORIDE BATH

The benefits to be gained from the high chloride bath are many and varied, any one of which, such as superlative anode corrosion, might be considered as sufficient justification for installation.

The amount of equipment needed for the plating operation is only about half of what is needed for other systems to do the same work in the same length of time. The author has several times taken existing plating lines and increased their capacity two to three times by converting to high chloride nickel operation. The only other changes made were to substitute Karbate heating for the lead coils, and to use more current. Smaller units take up less floor space, and cost less. Good agitation is desirable, but need not be costly or elaborate.

In the more economical use of power alone, because much lower voltage can be used, the bath quickly proves its worth, or in a bath operating at six volts the same load can be plated at the same voltage in half the time. On a ten thousand ampere machine a saving of only one volt can mean a saving of 80 kilowatt hours in one shift of operation.

The bath offers real savings in drag out because of its low metal or salt requirement for high speed plating. Sound conservation such as draining and the use of a well placed drag out rinse can cut losses to a point well within limits for safe disposal of rinse water. With nickel approximately a dollar a pound any saving here is well worth-while.

The bath is easy to maintain in a high state of purity, and easy to purify should it become necessary. The high chloride bath is capable of plating nickel over nickel with good adhesion. Trouble with laminated poorly adherent plate is seldom encountered.

CONVERSION OF EXISTING EQUIPMENT

In changing an existing Watts system to high chloride, several factors should be considered. Cleaners and rinse tanks must be reconsidered in case production is to be doubled. On the nickel tank buss bars, power units and connections should be of sufficient capacity. Particular attention must be paid to sliding contacts, and contact areas. They should be large enough not to overheat. Semi-automatic hooks have often been found too small in area, and racks in this case should be made with two heads to fit over two hooks. Plating racks that are adequate for chrome plating are usually adequate for nickel. Rack insulation is very important, and racks should be in good repair and free rinsing, to avoid contamination of the solutions with each other. No lead should ever come in contact with the solution. Lead is quite soluble in the high chloride bath and causes brittleness, poor adhesion and skipping in the recess.

TREATMENT

Solution treatment is largely confined to activated carbon treatment with occasional use of peroxide or permanganate for organic impurities. Chromic acid contamination can be eliminated by small additions of ferrous sulfate during filtration, and filtered out along with the ferric hydroxide and chromic hydroxide. Lead may be removed by electrolytic purification. The dummy cathodes should not be allowed to hang in the solution without current to prevent re-solution of the lead. Zinc is slower to remove by low current density electrolysis, unless very good agitation is used. Operation of the bath above *p*H 4.5, preferably 4.8 to 4.9, along with the use of adequate thickness of copper on zinc die-cast, will minimize zinc contamination.

Calcium can be almost completely removed as fluoborate by addition of small concentrations of nickel fluoborate, 1 to 3 grams per liter. The *p*H should be over 4.5. The calcium fluoborate is filtered out and if calcium was at saturation, it is best to settle the precipitate in the storage tank by addition of filter aid to the solution, and also make any addition of boric acid that may be needed at this time. Add it directly to the storage tank and when settling seems to be complete, filter the solution back to the plating tank. Once all calcium has been removed, further small additions of nickel fluoborate can do no harm and appear to have desirable effects on the ductility and leveling of the deposit. Additions of other fluoborate or fluoride salts do not seem to work as well, or not at all. Very little trouble is had with small percentages of iron. Iron will plate out with the nickel without noticeable harm just about as fast as it gets into the solution.

BRIGHTENERS

The plating supply houses that have brighteners publish operational bulletins and their recommendations on the use of their brighteners should very definitely be followed. It seems that more mileage can be had from the brighteners in the high chloride bath over the same brighteners in the Watts bath, and since bath volume is not as great, make up and standing losses are less. The amount of brightener in the bath should always be considered to avoid excessive use.

CONCLUSION

If a conviction based on many years of operation and comparisons including outdoor performance of the plated work, particularly on taxicabs, is valid, then nickel plated from the high chloride bath, under the conditions outlined in this paper, and plated correctly with chromium will be every bit as good as nickel from any other bath in commercial operation today.

Melvin Tippman started in the plating industry as a plater's helper at the Bay Mfg. Co. Division of the Electric AutoLite Co. in 1935. In 1941, he was made plant chemist and devised improved chemical processes and methods. In 1946, he joined Saginaw Industries Co., Saginaw, Mich., as plating superintendent. When material restrictions during the Korean conflict made it impossible to maintain product quality, and production was curtailed, Mr. Tippman went to Checker Motors Corp., Kalamazoo, Mich., as plating foreman. He is a charter member of the Saginaw Valley Branch, AES.

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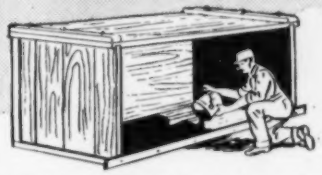

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Formax manufactures a complete line of Buffing and Polishing Compounds in bar, tube and liquid form suitable for all classes of metal, plastic and lacquer finishes. Formax compounds used together with the famous Formax ZIPPO long wearing buffing wheels make a combination that's hard to beat. Our extensive manufacturing, laboratory and testing facilities are always at your disposal.

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Now . . . the new Fulflo Rubber-Lined Steel Filter for plating cuts your filter maintenance costs in half, while providing tank turnover up to 3 times per hour.

New swing-bolt cover simplifies and speeds up changing elements. Just loosen the bolts, swing them out of the way, and lift off the cover to provide complete access to the patented Honeycomb Filter Tubes. Tubes are completely changed in a matter of minutes.

New bottom outlet allows for quick, easy cleaning of entire vessel simply by addition of a "T" connection with drain valve. You save time and labor.

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The new Fulflo Rubber-Lined Steel Filter is offered in six sizes, with from 6 to 60 Honeycomb Filter Tubes, for capacities up to 18,000 gph. Steel or stainless steel containers are also available.

It will pay you to look into this new Fulflo Filter to improve plating quality at lower cost.

For qualified engineering advice, or new technical literature, write to Department PL

COMMERCIAL FILTERS CORPORATION
MELROSE 76, MASSACHUSETTS
PLANTS IN MELROSE, MASSACHUSETTS AND LEBANON, INDIANA

MICRO-CLARITY AT MINIMUM COST

Fulflo FILTERS — *with genuine Honeycomb Filter Tubes for controlled micro-clarity of industrial fluids.*

CFC FILTERS — *Selective filtration of oils • water-oil separators • magnetic separators • pre-coat filters • coolant clarifiers • automatic tubular conveyors.*

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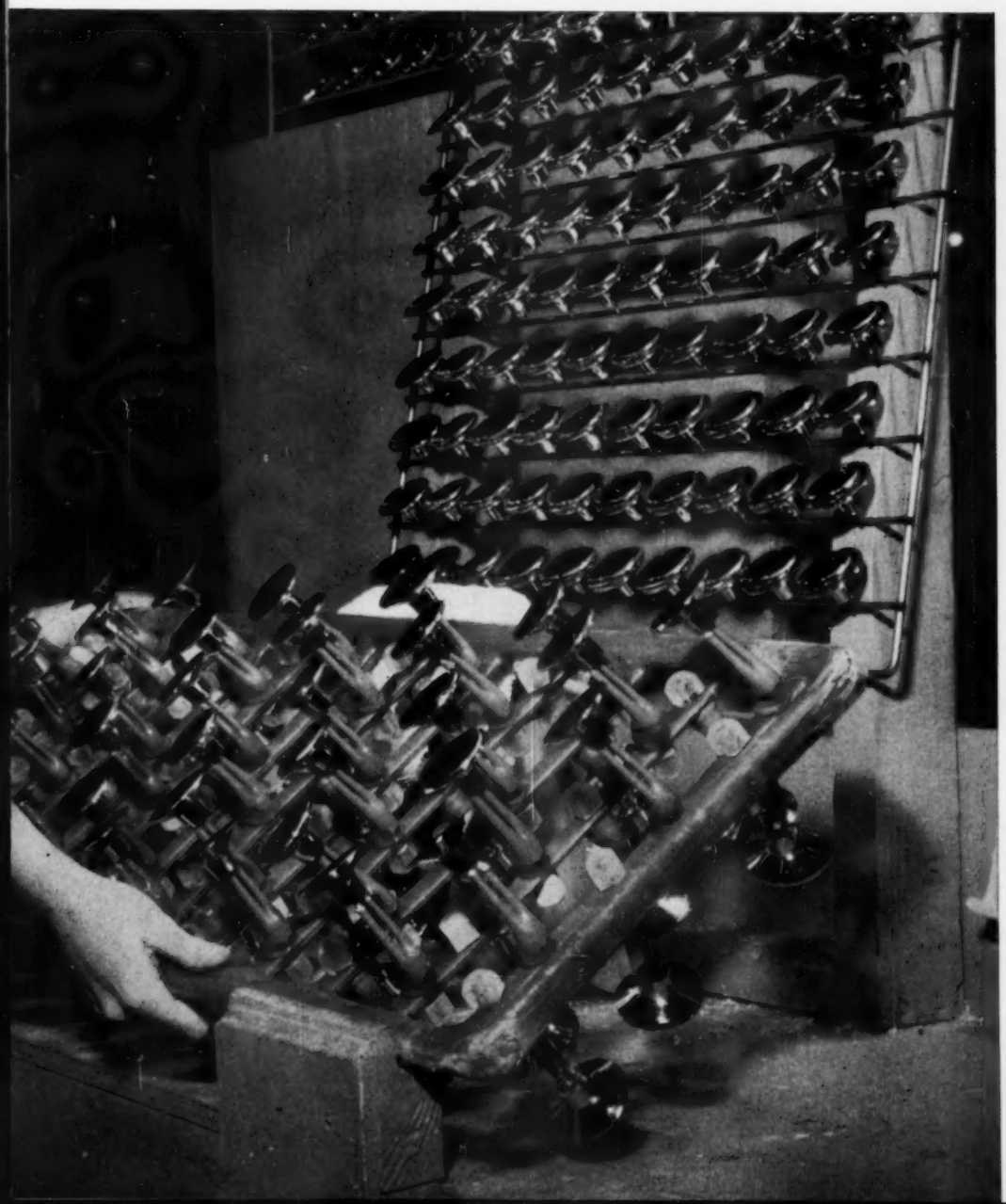

ASARCO

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LEADERSHIP AES NATIONAL CONVENTIONS 1960-1965

Tony Stabile
Chairman
Los Angeles Convention
1960

George J. Hetz
Vice Chairman
Los Angeles Convention
1960

Louis V. Gagnon
Chairman
Boston Convention
1961

Herman A. Tessman
Chairman
Milwaukee Convention
1962

Leonard E. Weeg
Vice Chairman
Milwaukee Convention
1962

Eugene Roth
Vice Chairman
Milwaukee Convention
1962

D. Gardner Foulke
Chairman
Atlantic City Convention
1963

Anthony P. Julius
Acting Chairman
St. Louis Convention
1964

Milton Nadel
Chairman
New York Convention
1965

LEADERSHIP AES COMMITTEES 1959-1960

Arthur W. Logozzo
Chairman
Credentials Committee

Manuel Ben
Chairman
Branch Exhibit Committee

John P. Nichols
Chairman
Editorial Board

Dr. Dodd S. Carr
Chairman
Educational Committee

Leslie L. Diveley
Chairman
Honorary Membership
Awards Committee

Manson Glover
Chairman
Law Committee

M. Lester Reynolds
Chairman
Membership Committee

Robert M. Norton
Chairman
Public Relations
Committee

William M. Tucker
Chairman
Paper Awards Committee

Dr. Samuel Heiman
Chairman
Publications Committee

Ralph D. Wysong
Chairman
Proctor Award
Committee

James D. Thomas
Chairman
Research Committee

Dr. Henry B. Linford
Chairman
Scientific Achievement
Award Committee

BRANCH PRESIDENTS, 1959-1960

ADELAIDE:
Mern K. Birrell
ALLENTOWN-READING:
Harold Bowen
BALTIMORE-WASHINGTON:
Edward E. Oberland
BLUE RIDGE:
Talmadge R. Boggess
BOSTON:
John R. Wright
BRIDGEPORT:
Allen Ferguson
BRITISH COLUMBIA:
N. A. Shepherd
BUFFALO:
Rolland E. Campbell
CAPITOL DISTRICT:
G. H. Green
CENTRAL MICHIGAN:
D. D. Trafelet
CHICAGO:
Charles Geldzahler
CINCINNATI:
Wm. B. Stephenson Jr.
CLEVELAND:
John Winters
COLUMBUS:
Marvin E. Pingel
DALLAS-FT. WORTH:
Myron E. Browning
DAYTON:
Bennie Cohen
DENVER:
R. D. Martin
DETROIT:
Donald M. Bigge
GRAND RAPIDS:
D. R. Smith
HAMILTON:
B. C. Teal
HARTFORD:
Armand Faucher
HOUSTON:
Jasper Dee
INDIANAPOLIS:
M. Lester Reynolds
KANSAS CITY:
G. Scott Sterrett
LANCASTER:
Clester Smith
LOS ANGELES:
George J. Hetz
LOUISVILLE:
Joseph P. Muscarella
MELBOURNE:
L. H. Esmore
MIAMI:
E. Owens
MILWAUKEE:
Sy Tatereczynski
MISSISSIPPI VALLEY:
Al W. Dennhardt
MOHAWK VALLEY:
Charles Bridgett
MONTREAL:
Richard Takeuchi
NEWARK:
Fred Meyer
NEW HAVEN:
George O'Connor Jr.
NEW YORK:
Joseph Rembecki
PHILADELPHIA:
James E. Cogan Jr.
PITTSBURGH:
W. F. Pizoli
PHOENIX:
William Griff
PORTLAND:
Ken Underdahl
PROVIDENCE-ATTLEBORO:
H. Leslie Ferguson
ROCHESTER:
Anthony J. Cottrone
ROCKFORD:
Stuart K. Golding
SAGINAW VALLEY:
D. W. Snyder
ST. JOSEPH VALLEY:
Ray J. Dearth
ST. LOUIS:
William Piel
SAN FRANCISCO:
Trevor G. Harry
SEATTLE-PUGET SOUND:
William P. Foley
SOUTHEASTERN:
Robert M. Taylor
SOUTHERN TIER:
Charles Emery
SPRINGFIELD:
Elery C. Gibson
SYDNEY:
W. Coulson
SYRACUSE:
Milton F. Stevenson
TOLEDO:
Harold Grutter
TORONTO:
R. J. Day
WATERBURY:
Frank Tirendi
WESTERN ONTARIO:
Leo Horodyski
WICHITA:
Glenn Summers

NEW YORK AND NEWARK JOIN FORCES FOR REGIONAL SESSION

The New York and Newark Branches of the AES will hold one joint metropolitan Regional educational session every year. The New York Branch will be the host at the first such meeting, to be held on Friday, September 25, 1959, at 8:00 p.m. at the Hotel Statler-Hilton in New York City.

Speakers for the evening are A. Mendizza, corrosion engineer at Bell Telephone Laboratories, who will speak on "Plated Coatings for Electrical Contacts," and Dr. Edward B. Saubestre, technical director at Enthone, Inc., whose topic will be "Metal Cleaning." A social hour will follow the meeting during which refreshments will be served.

PRESIDENT WYSONG NAMES 1959-1960 CREDENTIALS COMMITTEE

Past President Arthur W. Logozzo of Hartford has been appointed Chairman of the 1959–1960 Credentials Committee by National President Ralph D. Wysong and will lead that Committee that will accredit the 1959–1960 elected Branch Delegates/Alternates to compose the 1959-1960 Supreme Society, the AES's highest governing council. Serving with Chairman Logozzo will be Past President Cleveland F. Nixon of Detroit and Branch Past President Stanley Beyer of Louisville.

ASTM CONTRIBUTES TO AES RESEARCH

For the third successive year, the American Society for Testing Materials (ASTM) has initiated and made a $500 contribution to the work of the AES's Research Program, thereby demonstrating continuing confidence and interest in the effectiveness of that Program that currently embodies seven active Research Projects in American and Canadian universities and foundations.

To the ASTM, the AES and its Research Committee extend hearty thanks for this annual contribution, and for the splendid relationship that exists between the two bodies in matters of common interest.

TO ALL BRANCH SECRETARIES

1. **The tenure of your accredited Branch Delegates/Alternates composing the Supreme Society expires at the first Branch meeting following the June 18, 1959 meeting of the Supreme Society. A list identifying and authenticating the Delegates/Alternates elected by your Branch for 1959-1960 tenure is due in the hands of the National Executive Secretary by not later than November 2, 1959. An official Return Sheet upon which to list your 1959-1960 Delegates/Alternates for accreditation by the Credentials Committee will shortly be sent to you. It requires signature of both the Branch President and Secretary.**
2. **The due-date of your Branch Per Capita Taxes at the new rate is October 1, 1959 for the fiscal year from July 1, 1959 through June 30, 1960.**
3. **Your Branch, via its accredited Delegates, will be invited to nominate any qualified member of the Society whom it chooses for consideration for the AES Scientific Achievement Award. Your choice must be supported by six copies of a statement of your nominee's qualifications. These are due in the hands of the National Executive Secretary by not later than October 15, 1959 by the Award's regulations.**
4. **Your Branch, via its accredited Delegates, will soon be invited to nominate any qualified member of the Society whom it chooses for consideration for AES Honorary Membership. Your choice must be supported by six copies of a statement of qualifications. These are due in the hands of the Executive Secretary by not later than November 15, 1959 by the rules of the Supreme Society.**
5. **Your Branch, through its President, will be invited to nominate any member of the Society whom it chooses for consideration for the Charles Henry Proctor Memorial Leadership Award. More information soon.**

AES NEWS

INTERIM MEETING TO CLIMAX PHILADELPHIA BRANCH ANNIVERSARY

Back in 1910, in the second year of life of the National Electro-Platers Association of the United States and Canada (NEPA), today's AES, adroit Frank C. Clement championed the branching of NEPA into the Commonwealth of Pennsylvania, and today's Philadelphia Branch drew breath that year for the first time, second oldest of the Society's current 58 chartered Branches. Consequently, like PLATING MAGAZINE, it will celebrate its Fiftieth Anniversary in 1960, and the entire Society will honor its second oldest component Branch upon arriving at that milepost of its existence.

Climax of the Philadelphia Branch's Golden Anniversary observance will be the two-day Fiftieth Anniversary Educational Program and Banquet that it will conduct concurrently with the Seventh Interim Meeting of the Supreme Society for which it was recently chosen as Host Branch. Dates will be February 19–20, 1960. Site will be the Ben Franklin Hotel in Philadelphia. AES members present will not only be educationally benefited but the Anniversary will also be fittingly observed when the Society converges upon the Keystone City next February—a return visit to the Branch that hosted the very first Interim Meeting back in 1951.

PHOENIX AND DENVER BRANCHES PERMANENTLY CHARTERED

The Executive Board has approved the respective petitions of the temporarily chartered Phoenix, Arizona, and Denver, Colorado, Branches for permanent charter and both Branches have therefore now become chartered AES Branches.

The formal installation of the Phoenix Branch will occur in that community early in October—the Denver Branch will be formally presented with its permanent charter and installed at a suitable ceremony to take place in that city the week following.

Installation team will be National President Ralph D. Wysong and National Executive Secretary John P. Nichols who will pause in Phoenix enroute to Los Angeles on 1960 AES Convention business, then stop off at Denver on the home-bound trip from the West Coast.

REGIONAL MEETINGS TO SPARK AES's 1959-1960 EDUCATIONAL SEASON

American Electroplaters' Society is composed currently of 58 thriving-Branches—not counting either the resigned Twin City Branch or the San Antonio Branch emasculated by dwindled plating and metal finishing operations in that community—but including dynamic new AES Branches in Denver, Colorado, and Phoenix, Arizona. Over half of AES's 50 American Branches are now grouped together in regional bodies, namely Dixie (3 Branches); Midwest (6 Branches); Tri-State (5 Branches); New England (5 Branches) and Empire State (6 Branches). The Metropolitan group composed of the New York "Mother" Branch and Newark Branch is the latest formed. And a seventh group is now in process of creation embodying at least three of AES's Southwestern Branches.

A prime function of these regional groups is to conduct attractive regional educational sessions, and the 1959–1960 season is fast shaping up as a significant period in this connection in AES's half-century lifetime.

The season will make its debut with the first Metropolitan Regional Educational Meeting ever conducted. Staged in the Penn-Top Room of New York City's Statler Hotel starting at 8 p.m. on Friday, September 25, the affair will be sponsored by the New York and Newark Branches with the former as Host Branch.

Another anticipated "first" will be the first Midwest Regional Conference. It will be conducted at Rockford College, Rockford, Illinois, November 7, with the Rockford Branch as Host to the six signatory Branches of the Midwest Council, namely Chicago, Milwaukee, Mississippi Valley, Rockford, St. Joseph's Valley and St. Louis. A broad educational program is in the making as fare.

Fresh from its successful first Dixie Regional Technical Session held in Atlanta, Georgia, last February with the Southeastern Branch as host, the Dixie group will hold its second such session at the Saxony Hotel, Miami Beach, Florida, on January 15-16, 1960 with the Miami Branch as host. Blue Ridge is the third Branch of this live group.

Always effective, the 1960 Tri-State Regional Meeting will be held at the Sheraton-Gibson Hotel, Cincinnati, April 23 with the experienced Cincinnati Branch as Host. The hotel will be remembered as site of the AES's 1958 Annual Convention, and the Branch will be recalled as the industrious host of that well-considered annual assembly. Components of this region, besides Cincinnati, are Columbus, Dayton, Indianapolis and Louisville.

The Sixth Empire State Regional will this year be held on April 29–30 at the Mark Twain Hotel in Elmira, N. Y., with the Southern Tier Branch as host. This group is composed, besides Southern Tier, of Buffalo, Capitol District, Mohawk, Valley, Rochester and Syracuse.

Oldest of all the AES regions, and selected locale of the Society's Eighth Interim Meeting of the Supreme Society to be held early in 1961, the New England Region is well-known for the caliber of its Annual Educational Sessions. Elements of that regional group are the Bridgeport, Hartford, New Haven, Springfield and Waterbury Branches. The Twenty-first New England Regional meeting will take place on April 23, 1960 at the Hotel Statler in Hartford.

WILLIAM M. TUCKER HEADS AES's 1959-1960 PAPER AWARDS COMMITTEE

To head the 1959-1960 AES Paper Awards Committee, National President Ralph D. Wysong recently appointed William M. Tucker, Eastman Kodak Company, a Rochester Branch member with a distinguished record of AES service. A recent member of the Editorial Board, Chairman of the current Project No. 14 Committee, prominent in the field of corrosion, Mr. Tucker is a former Chairman of the AES Research Committee and a winner of the AES Award of Merit.

Also appointed to serve on that important Committee that will select the 1959-1960 winners of the Carl E. Heussner AES Gold Medal Award; the AES Silver and Bronze Medals; the George B. Hogaboom Award; the Robert S. Leather Award; the Chromium Plating Award; the Precious Metal Plating Award and the John J. Hanney Memorial Award are Clarence H. Sample, International Nickel Company, and Dr. Henry Brown, The Udylite Research Corporation.

Photographs courtesy of H-VW-M official Convention News

AES LADIES' DAYS AT GOLDEN JUBILEE CONVENTION

A glimpse of some of the ladies functions at the AES's GOLDEN JUBILEE Convention. (1) Luncheon at the Detroit Yacht Club. (2) Head table at the Yacht Club luncheon. Mrs. Alice Pillsbury, chairman of the Ladies Committee is at the microphone. (3) Head table at the Aunt Ella luncheon at the Dearborn Inn. David X. Clarin (Aunt Ella) at the mike. (4) Mr. Clarin and Mrs. Pillsbury. (5 & 6) The ladies at the traditional Aunt Ella luncheon.

YOU'LL LOOK AROUND AND SURELY SAY "EUREKA"

In July 1960, in the AES's fifty-first year, AES members and their families, along with visitors and guests from other countries, will migrate to California, the Golden State beyond the Rockies, from all parts of the North American continent and abroad, to attend the 47th Annual Convention of the American Electroplaters' Society, first such mammoth AES assembly ever held on the Pacific Coast. For a host of AES families, this will be a long-time dream finally materialized.

Never before has AES ventured westward beyond St. Louis to conduct an Annual Convention of its membership. Why, therefore, was Los Angeles chosen by the Supreme Society to host the 1960 Annual Convention, first assembly of the Society's swelling membership in its second half-century of life?

THE GOLDEN STATE: AN AREA OF PROGRESS

Since that midsummer day in 1846 when Commander John D. Sloat raised the American flag at Monterey and paved the way for California's admittance to the Union on September 9, 1850, that state has become the "Goliath" of our West Coast—second largest state in the Union until Alaska's recent upgrading to Statehood.

In January 1956, the Bureau of the Census estimated that the Golden State with the motto of "Eureka" or "I Have Found It," had the largest population increase (nearly 3 million) of any single State between April 1, 1950 and July 1, 1956. That boost swelled its population to nearly 13½ million for a population gain of nearly 30 per cent during that span alone.

Apart from the historic, cultural, scenic, entertainment and relaxational attractions that make our Golden Gate State a magnetic wonderland, California today is also one of our nation's industrial titans. Just as the first "Gold Rush"—started at Sutter's sawmill by James Marshall in 1848—allured a veritable mass influx of settlers to California, so too has industry since then come, saw and sunk deep roots there, especially since World War II.

LOS ANGELES: ITS MIGHT AS CONVENTION SITE

Los Angeles itself, the world's largest city in actual area, had an estimated population of nearly 2½ million in 1957, with a total of nearly 6 million inhabiting its renowned metropolitan area.

In the decade from 1946 through 1956, new industrial investment in Los Angeles County alone reached $1,845 billion, much of it in aircraft, automobile, and steel manufacture. Despite its aura of play and fun, the area became the nation's third largest industrial center in 1956. More than 500 nationally known companies operate branch plants there—and, in 1956, these set a record in industrial enlargement with $46 million spent in construction of new plants and $298 million expended by 383 companies on company expansion.

EDUCATION AS LOS ANGELES CONVENTION'S GOAL

Distance and travel expense are, of course, drawbacks that were calculatedly risked by the Supreme Society in tapping Los Angeles to serve as Host Branch of the 47th Annual Convention.

And so as to justify the long cross-country trek of the AES family, the Los Angeles Branch is preparing the type of Convention that will attract large audience regardless of distance.

With dates set for July 24–28, 1960 so as to enable AES families to travel during vacation time, the main appeal of the Convention is being beamed to the very mission of the AES, namely educational enrichment—though large and impressive plans are also being made featuring the entertainment, sightseeing and relaxation for which Los Angeles is world famed.

Under consideration by the Editorial Board at this writing is a seven session-thirty paper 1960 Los Angeles Convention educational program. And whereas nearly every element of electroplating, metal finishing, organic coating and allied arts will be accommodated, among the attractions being considered besides the second "William Blum Lecture" that will be delivered at the Opening Educational Session by Dr. A. Kenneth Graham, second winner of the AES Scientific Achievement Award, will be a day-long symposium on "hydrogen embrittlement" starring many of that subject's outstanding experts.

YOU'LL LOOK AROUND AND SURELY SAY, "EUREKA"

Now is the time to start planning that California search for knowledge. Be on hand when, as the California sun shines bright, your AES is officially welcomed to that land of the Golden Poppy, the Valley quail and the Redwood tree at the Convention's Opening Session, July 24, 1960. Be among those who, voicing the State's famed motto, will look around and conclude, "Eureka. I have found it."

(Left) Beautiful Union Station, Los Angeles rail terminus of Spanish architecture. (Center) Paddlewheel steamer on Disneyland's "Rivers of America." (Right) Famous Wilshire Boulevard, looking across MacArthur Park.

CONSTITUTION
of the
AMERICAN ELECTROPLATERS' SOCIETY

(As of June 18, 1959)

FOREWORD

For the immediate information and benefit of the present membership of the American Electroplaters' Society, in all of its ramifications, herewith the Society's Constitution and By-Laws as amended by the Supreme Society at its Annual Meetings in Cincinnati, May 22, 1958 and in Detroit, June 18, 1959.

Because of the volume and complexity of amendments enacted by the Supreme Society at that Detroit meeting, some minor errors may have crept in. Any such inadvertences discovered will be corrected in the pamphlet edition and by errata published in PLATING MAGAZINE.

PREAMBLE

NAME, OBJECT, AND DIVISIONS

This society shall be known as American Electroplaters' Society, Incorporated, hereinafter called the Society. It shall be incorporated under the laws of the State of New Jersey.

The object of the Society shall be the improvement and dissemination of the knowledge of the arts and sciences of electroplating and of finishing of metals and of allied arts, the development of a cooperative spirit of friendship, and mutual assistance among its members.

The Society shall consist of members duly elected to membership under the Constitution and By-Laws. There shall be branch or local societies, hereinafter called Branches, duly organized under the Constitution and By-Laws as integral parts of the Society. The Branches shall consist of members of the Society who have become members of the Branches of their choice through the procedures established by the said Branches under the provisions of this Constitution.

There shall be a governing body called the Supreme Society, consisting of Delegates duly elected by the several Branches.

There shall be an Executive Board, duly elected by the Supreme Society in accordance with the Constitution and By-Laws.

PART I. THE SOCIETY

ARTICLE I. FUNCTIONS

Section 1. Organization: The Supreme Society shall consist of three Active Members in good standing from each Branch in good standing, hereinafter called Delegates, whose credentials have been duly accepted. An elected Officer of the Society shall automatically be one of the three Delegates from his Branch. A quorum for the transaction of the business of the Supreme Society shall be two-thirds of the Delegates, present in person or by proxy.

The Executive Board shall consist of the President, the Past President, the First Vice President, the Second Vice President, and the Third Vice President. A quorum for the transaction of the business of the Executive Board shall be four of the above-named Officers.

Section 2. Authority: The Supreme Society shall be the governing body of the Society, and all Branches shall be subject to the laws by it enacted. Its decisions shall be final.

The Executive Board shall be the administrative body of the Supreme Society. It shall conduct the ordinary business of the Society under the provisions of the Constitution and By-Laws and the rulings of the Supreme Society. Its decisions shall be subject to review by the Supreme Society.

ARTICLE II. MEMBERSHIP

Section 1. Members: Any person interested in the object of the Society may become a member.

Section 2. Classes of Membership: The Society shall consist of Active Members, Student Members, Sustaining Members, and Honorary Members.

Section 3. Active Members: Any person interested in the object of the Society may be elected an Active Member.

Section 4. Student Members Any person not over twenty-five years of age, regularly enrolled in full-time courses at any accredited university or other institution of learning and interested in the object of the Society may be elected a Student Member.

Section 5. Honorary Members: Honorary Membership may be conferred by majority vote of the Supreme Society in Annual Meeting upon any person whose knowledge and outstanding service have enhanced the welfare of the Society. A Branch desirous of having any person elected Honorary Member shall nominate that person, with appropriate information in support of his eligibility, to the Executive Board. If a majority of the Executive Board approve the nomination, it shall be presented for vote to the Supreme Society at the next Annual Meeting.

Section 6. Sustaining Members: Any

firm or person interested in the electroplating and metal-finishing industry or in the object of the Society may be elected a Sustaining Member by majority vote of the Executive Board.

An Active Member may also be a Sustaining Member.

Section 7. Privileges: Student Members and Sustaining Members shall have all rights of membership except those of voting and holding office. Members not belonging to Branches shall have all rights of membership except holding office or election as Delegates.

Section 8. Branch Membership: Application for membership in a Branch shall be made by the candidate for admission to the Branch Secretary on the official form accompanied by the application fee. The Branch Secretary shall submit the application to the Board of Managers or other established body of the Branch, which shall investigate the references of the candidate and approve or disapprove the application by majority vote. An approved application shall at the next regular meeting of the Branch be submitted to the Branch for action. The Branch Secretary shall immediately notify the Executive Secretary of the election of any new member.

Section 9. Membership-at-Large: A candidate for membership not desiring membership in any Branch may become a Member-at-Large. However, Membership-at-Large shall be held to 25 per cent of the entire membership of the Society and when the Membership-at-Large shall equal 25 per cent of the total membership of the Society, Membership-at-Large shall be closed until increase in total membership warrants reopening. Application for Membership-at-Large in the Society shall be made to the Executive Secretary on the official form accompanied by the application fee. The Executive Secretary shall submit the application to the Executive Board, which shall investigate the references of the candidate and shall within thirty days of receipt of application admit or reject the candidate by majority vote.

Section 10. Obligation: Each applicant for membership shall receive a copy of the Constitution and By-Laws and shall read and accept same. He shall not be permitted to plead ignorance in extenuation of any violation of their provisions.

Section 11. Transfer: A member in good standing may transfer from one Branch to another Branch, from Membership-at-Large to membership in a Branch, or from membership in a Branch to Membership-at-Large, with the consent of the governing bodies involved and through such procedure of transfer as may be established by the Executive Board of the Society.

Section 12. Resignation: A member shall be permitted to resign from the Society only when his dues shall have been paid in full to date of resignation.

Section 13. Expulsion: A member having made false or misleading statements in applying for membership or having acted in violation of the Constitution may be expelled from the Society by the Branch, or in the case of a Member-at-Large by the Executive Board, and all monies received from him shall be forfeited by him. However, before acting upon any measure of expulsion, the Branch or the Executive Board, as the case may be, shall provide the alleged offender with full and due opportunity to defend himself in open hearing against the charges brought against him.

Section 14. Reinstatement: Any former member of the Society who may wish to be reinstated shall be considered a new candidate for membership.

Article III. Duties of Members

Section 1. Voting: Delegates may vote in person or by proxy at the Annual Meeting of the Supreme Society. Each Branch shall be entitled to three votes, provided that at least one Delegate or Alternate is present to cast the votes of the entire delegation. The Branch delegation of which a presiding officer is a member may replace him with an Alternate on the floor of a meeting. The presiding officer at a meeting of the Supreme Society may cast a deciding vote in case of tie.

Section 2. Proxies: A Delegate or Delegates may exercise the proxy of any Delegate elected by the Branch, and the Delegates of any Branch may represent not more than one other Branch by proxies duly presented to the Credentials Committee and accepted by the Supreme Society.

Article IV. Officers

Section 1. Roster: The Officers of the Society shall be Past President, President, First Vice President, Second Vice President, Third Vice President, Executive Secretary, and Residing Legal Officer. A member residing in New Jersey shall be Residing Legal Officer of the Society in the State of New Jersey. The Executive Secretary and Residing Legal Officer shall be appointed by the Executive Board, and each shall serve until his successor shall have been appointed and takes office. All other Officers of the Society except the Past President shall be elected.

Section 2. Qualifications: Each Officer of the Society shall be an Active Member of the Society in good standing. Each elected Officer shall further be a Delegate. Each candidate for elective office shall be a Delegate (or Alternate) elected or appointed at a regular Branch meeting. The President of the Society shall before election have served at least one term on the Executive Board.

Section 3. Term: The term of an elected Officer shall be for one year or until his successor shall have been elected or appointed and installed. No person shall hold the same elective office more than two terms in succession.

Section 4. Vacancy: In the event of a vacancy in the office of President, the Vice President highest in rank shall succeed.

Section 5. Past President: The retiring President shall become the Past President of the Society.

Article V. Finance

Section 1. Application Fees: The minimum application fee shall be five dollars. Application fee shall be submitted with each application for membership and paid to the Branch, or in case of application for Membership-at-Large to the Supreme Society.

Section 2. Annual Dues: (a) The Minimum annual dues of Active Members of North American Branches shall be seven dollars and fifty cents. Those of Active Members of Australian Branches shall be five dollars and seventy cents. (b) One dollar of the annual dues of each such Active Member shall be used to support research. (c) The minimum annual dues of Student Members shall be five dollars. (d) The minimum annual dues of Sustaining Members shall be one hundred dollars and shall be paid to the Executive Secretary. (e) The dues of Members-at-Large shall be paid to the Executive Secretary. (f) Honorary Members shall be exempt from payment of dues.

Section 3. Per Capita Tax: (a) From the annual dues of each Active Member of a North American Branch there shall be paid to the Supreme Society, a Per Capita Tax of seven dollars and fifty cents ($7.50). From the annual dues of each Active Member of an Australian Branch there shall be paid to the Supreme Society, a Per Capita Tax of five dollars and seventy cents ($5.70). (b) Of the Per Capita Tax of each such Active Branch Member two dollars ($2.00) shall be used to pay the annual subscription to the official journal of the Society and one dollar ($1.00) shall be paid into the Research Fund. (c) From the annual dues of each Sustaining Member there shall be paid to the Supreme Society a Per Capita Tax of four dollars and seventy cents ($4.70), of which two dollars ($2.00) shall be used to pay the annual subscription to the official journal of the Society.

Section 4. Fiscal Year: The fiscal year of the Society shall commence on the first day of July. All financial reports shall be made from and all transactions closed to conform with the end of the fiscal year on the thirtieth day of June.

Article VI. Meetings

Section 1. Annual Meeting: The Annual Meeting for the transaction of business of the Supreme Society shall take place during the Annual Convention. The

Annual Meeting and Convention shall be held on dates agreed upon by the Executive Board and the Branch designated to entertain the Convention, hereinafter called the Host Branch. In national emergency the Executive Board may suspend the Annual Meeting and conduct the affairs of the Society and Supreme Society by letter ballot.

Section 2. Special Meetings: A Special Meeting shall be called by the President upon the written application of a majority of the Branches. The purpose of such Special Meeting shall be stated in writing in the application and the Executive Secretary shall send a copy of the said statement to each Delegate. No business not included in the said statement shall be transacted at any Special Meeting.

Article VII. Charters

Section 1. Granting and Voiding: The Executive Board may grant Temporary or Permanent Charters to Branches duly organized under the Constitution and By-Laws. The Executive Board may at its discretion revoke any Temporary Charter. The Supreme Society may on the recommendation of the Executive Board or upon presentation of evidence revoke for cause the Permanent Charter of a Branch.

Section 2. Temporary Charters: A Temporary Charter may be granted to any group, provided that:

It shall have a membership of not less than ten persons eligible for Active Membership in the Society. Any of these persons may be members of an existing Branch.

Each applicant not already a member of the Society shall make application for Active Membership to the Executive Secretary as provided in this Constitution, and applicants already members shall submit evidence of good standing. The requisite number shall be acceptable to the Executive Board.

The applicants shall petition in writing for a Charter, and each applicant shall over his signature pledge loyal support to the Society and obedience to its Constitution and By-Laws.

Section 3. Duration of Temporary Charter: A Temporary Charter shall be in force until a Permanent Charter is granted or until it is revoked by the Executive Board. The Executive Board shall revoke any Temporary Charter if application for a Permanent Charter be not made within one year of issue of the Temporary Charter.

Section 4. Permanent Charter: The Executive Board shall grant a Permanent Charter upon written application to any Branch that has operated for three or more months under a Temporary Charter.

Section 5. Branch Franchise: Charters shall not be granted to more than one Branch in any city.

Article VIII. Official Publications

Section 1. Official Journal: The Society shall publish periodically an official journal which shall contain articles pertaining to the object of the Society, changes in membership, news of the organization and its members and of the industry in general, and other matters of value to the membership. Each member of the Society in good standing shall receive a copy of the official journal for two dollars ($2.00) paid to the Society out of his annual dues. Non-members shall be offered subscription at the regular price.

Section 2. Proceedings: Each member in good standing shall receive a copy of the technical proceedings of the Annual Convention.

Section 3. Minutes of Annual Meetings: Minutes of each meeting of the Supreme Society shall be sent to each Delegate and Alternate and each Branch President and Secretary.

Section 4. Release of Papers: Papers presented before a Branch shall be the property of the authors. With the consent of the authors, a Branch may offer such papers for publication in the official journal of the Society.

PART II. BRANCHES

Article I

Section 1. Names: A Branch shall be known as————Branch of the American Electroplaters' Society, the blank in this name being the name of the city or locality of the Branch.

Section 2. Organization: Branches shall elect their own officers and may operate under any rules or laws of their own choosing not inconsistent with the Constitution and By-Laws of the Society. Any special laws or rules of a Branch shall be filed with the Executive Secretary.

Section 3. Finances: A Branch may receive donations or bequests and may expend or invest the same at its own discretion. A Branch may levy assessments and otherwise raise or collect funds for its own purposes and shall have the entire use and management of such funds.

PART III. REVISION OF CONSTITUTION

Article I

Section 1. Authority: This Constitution or any part thereof may be repealed, altered, annulled, or otherwise amended by a two-thirds vote, either at an Annual Meeting by roll call or by letter ballot, after regular procedure of initiative and notice as provided in Sections 2 and 3 of this Article.

Section 2. Initiative: Due notice shall be given and a vote shall be taken on any revision submitted by four or more Branches or approved by the Executive Board.

Section 3. Notice: On receipt of a revision duly submitted, the Executive Board shall immediately cause such revision to be reviewed by the authority constituted for that purpose, properly worded and classified, and published in the official journal of the Society at the first opportunity and in any case not later than three months from receipt of the said revision. Vote of the Delegates on the revision shall be taken within three months of its publication in the official journal.

BY-LAWS

(As of June 18, 1959)

PART I. THE SOCIETY

Article I. Election of Officers

Section 1. Time and Method: The Officers of the Society shall be elected during the Annual Meeting by roll call of the Delegates after nomination and second from the floor. A Delegate nominating any candidate for office in the absence from the floor of the said candidate shall vouch for the willingness of the said candidate to serve if elected.

Section 2. Majority Vote: A candidate receiving a majority of votes cast shall be declared elected. In case of no majority on a first roll call, the candidate receiving the fewest votes shall be dropped from consideration and another vote taken; and this procedure shall be repeated until a majority vote shall have been cast for one candidate.

Section 3. Installation: Installation of Officers shall take place immediately after their election.

Article II. Duties of Officers

Section 1. Reports: Each Officer of the Society shall make a report of his activities to the Annual Convention.

Section 2. President: It shall be the duty of the President to preside over all meetings of the Society, to preserve order, to put all proper motions before the meeting if duly seconded, to decide all questions of order subject to appeal to the meeting, and to cast the deciding vote in case of tie. He shall be Chairman of the Executive

Board. In honor of his office he shall be a member of all committees. He shall call all Special Meetings of the Society and all meetings of the Executive Board. He shall appoint all committees not otherwise provided for. He shall be responsible for all expenditures made by the Executive Secretary. When an Officer resigns or dies the President shall, with the approval of the Executive Board, appoint a qualified member of the Society to fill the vacancy for the unexpired term. He shall be Chairman of the Selection Committee of the Charles Henry Proctor Memorial Leadership Award.

Section 3. First Vice President: The First Vice President shall perform the duties of President in case of death, resignation, or absence of the President. He shall be a member of the Educational Committee and shall perform such other duties as may be assigned him by the President or the Executive Board.

Section 4. Second Vice President: The Second Vice President shall perform the duties of President in the absence of the President and First Vice President. He shall be a member of the Membership Committee and shall perform such other duties as may be assigned him by the President or the Executive Board.

Section 5. Third Vice President: The Third Vice President shall perform the duties of President in the absence of the President and First and Second Vice Presidents and such other duties as may be assigned him by the President or the Executive Board. He shall be a member of the Exhibit Awards Committee.

Section 6. Executive Board: The Executive Board shall meet at the call of the President at intervals of not more than four months. The President shall send to each Board member, thirty days prior to the meeting, an agenda of the items of business to be considered. No proposals, other than those on the agenda, can be brought before the Board, except by unanimous consent of the Board. It shall conduct promptly and diligently the ordinary business of the Society. It shall review nominations for Honorary Membership and be responsible for the election of Sustaining Members and the election and expulsion of Members-at-Large. It shall grant all Charters and may revoke Temporary Charters. It shall prepare the Budget and faithfully oversee the finances of the Society, and shall be responsible for audit of the accounts of the Society by a public accountant for report to the Annual Meeting and at any other times it may deem necessary. It shall oversee disbursement of all special funds. It shall appoint the Executive Secretary and the Residing Legal Officer and shall have authority over their duties. With the Host Branch, it shall select the date for the Annual Meeting and Convention, and it shall approve plans for these before their execution. It shall receive and transmit proposals for amendment of the Constitution and By-Laws. It shall approve any call for a Special Meeting of the Supreme Society and shall designate the place and time of such meeting. It shall furnish to the Branches the Society Emblem and necessary standard forms on such terms as may be determined by the Supreme Society. It shall carry out such other business as may be referred to it by the President or the Society. In national emergency, it may at its discretion suspend the Annual Meeting and conduct the business of the Supreme Society by letter ballot.

Section 7. Executive Secretary: The Executive Secretary shall be the business officer of the Executive Board and shall be responsible to the Board. He shall conduct the correspondence of the Society with the Branches promptly and diligently and shall maintain an accurate record of the membership of the Society with a view to efficient promotion of the object of the Society. He shall keep accurate record of the proceedings of the Supreme Society and of the Executive Board. He shall promptly inform the Branches, by whatever means he deems best, of the important proceedings of the Executive Board. He shall supply to each newly elected member a copy of the Constitution and By-Laws of the Society. He shall receive all funds of the Society, shall deposit said funds as directed by the Executive Board, and shall pay promptly with the approval of the President all bills presented to him for payment from the General and Special Funds and shall make disbursements from the Research Fund with the approval of the Research Committee. He shall receive and give receipt for all funds paid to the Society by the Branches. He shall keep such books of account as the Executive Board shall direct. He shall be Chairman of the Employment Committee. He shall preserve for ready access all papers and documents pertaining to his office. He shall be Managing Editor of the official journal; as such he shall appoint the members of the editorial staff, see to the editing and publication of such matter as the Society shall direct and to the copyright of appropriate publications of the Society, and preserve for ready access all valuable papers submitted by members and Branches. He may arrange exchange of publications with other appropriate journals and institutions. He may release papers presented at the Annual Meeting for publication outside the Society with proper credit and may at his discretion release papers not published by the Society. He shall have charge of advertising in the official journal. He shall distribute the official journal to the members of the Society. His salary shall be fixed by the Executive Board, subject to approval by the Supreme Society. He shall furnish the bonds required by the Executive Board. He shall be a member *ex-officio* of the Convention Committee and shall arrange for audit of the accounts of all Conventions. He shall be responsible for all matters pertaining to the publication of the Annual Convention program. He shall be Secretary of the Research Committee and shall be a member of the Public Relations Committee. He shall poll the Delegates for nominations for Honorary Member and shall provide certificates for those elected. He shall be a member of the Selection Committee of the Charles Henry Proctor Memorial Leadership Award.

Section 8. Residing Legal Officer: The Residing Legal Officer shall establish the legal residence of the Society as required by the Laws of the State of New Jersey. He shall carry out such duties pertaining to his office as may be assigned him by the Executive Board.

Article III. Committees

Section 1. Appointment: As soon as feasible after his election the President shall appoint all necessary committees not otherwise provided for. Unless otherwise specified, all members of these committees shall be Active Members of the Society.

Section 2. Credentials Committee. The Credentials Committee shall be empowered to accept at any time the credentials of duly elected Delegates, subject to review by the Supreme Society in Annual or Special Meeting (but not in Interim Meeting). In preparation for each Annual or Special Meeting it shall consider all credentials and proxies of Delegates and shall present its findings for action by the Meeting.

Section 3. Law Committee: The Law Committee shall receive all proposed amendments to the Constitution and shall see to it that said amendments are properly worded and classified for immediate publication in the official journal. It may at its discretion consult with the proponents of said amendments for clarification of language and meaning, and in no case shall it so modify an amendment as to alter the intent of said proponents. It shall examine all new rules and laws of the several Branches and Standing Committees, and any amendments thereof, for inconsistencies with the laws of the Society and shall certify those found free of such inconsistencies.

Section 4. Budget Committee: The Executive Board shall be the Budget Committee. It shall submit to the Annual Meeting of the Society a budget of estimated receipts and expenditures for the coming fiscal year. This budget shall provide for the ordinary business of the Society but not for the Research Committee or the official journal, which shall operate as enterprises independent of its provisions. After this or an amended

budget has been approved by the Supreme Society, expenditures shall not be increased by more than 20 per cent in any category without the approval by letter ballot of a majority of the Supreme Society.

Section 5. Research Committee: The Research Committee shall consist of nine members of the Society and the Executive Secretary. It shall operate under its own By-Laws when certified by the Law Committee and approved by the Executive Board. A representative of any technical organization designated by the Executive Board may be invited to participate in an advisory capacity in the work of the Committee. Of the nine members of the Society, three shall be appointed each year by the Executive Board, and the term of each such member shall be three years or until his successor has been appointed and installed. No member shall be appointed to the Committee for more than two consecutive terms. Upon its annual organization, the Committee shall select its Chairman and designate a Sub-Committee on Disbursements. The Executive Secretary shall be Secretary of the Committee.

The Research Committee shall be authorized to solicit funds for research from any source. Such funds and such other monies as are herein so allocated shall be held in the Research Fund by the Executive Secretary and disbursed by him with the approval of the Committee.

The Research Committee shall cooperate with the Executive Board on its general plans for the ensuing year, including those for such cooperation with other societies and institutions as it deems expedient. Upon approval of a plan by the Executive Board, it may carry out the said plan, employing personnel and publishing and distributing results in cooperation with the Executive Secretary.

The Chairman shall call a meeting of the Committee during the Annual Convention and at least one other time during the fiscal year at a place convenient to the membership of the Committee. Reports of the work of the Research Committee shall be made to the Annual Meeting of the Society and as far as feasible to Branch and Regional meetings.

Section 6. Membership Committee: The Membership Committee shall consist of nine members of the Society and the Second Vice President. Of the nine members of the Society, three shall be appointed each year by the Executive Board, and the term of each member shall be three years or until his successor has been appointed and installed. No such member shall be appointed to the Committee for more than two consecutive terms. Upon its annual organization, the Committee shall select its Chairman and Secretary. The Committee shall take appropriate measures to retain and increase the membership of the Branches. An award shall be presented annually to that Branch in each contest group making the largest per cent of gain in membership. Such award shall be purchased by the Society and shall remain the property of the Branch. It shall operate under its own By-Laws when certified by the Law Committee and approved by the Executive Board.

Section 7. Educational Committee: The Educational Committee of the Society shall consist of nine members of the Society and the First Vice President. Of the nine members of the Society, three shall be appointed each year by the Executive Board, and the term of each member shall be three years or until his successor has been appointed and installed. No such member shall be appointed to the Committee for more than two consecutive terms. Upon its annual organization, the Committee shall select its Chairman and Secretary. This Committee shall assist Branches to improve their educational sessions by securing speakers and programs and cooperating in the organization of classes. It shall operate under its own set of By-Laws certified by the Law Committee and approved by the Executive Board.

Section 8. Committee on Paper Awards: A Committee on Paper Awards shall be appointed and shall operate under the rules for the Committee appended to these By-Laws. The said rules may be amended and modified from time to time, as circumstances require, by the Committee with the approval of the Executive Board. No member of the Committee shall be eligible for award.

Section 9. Scientific Achievement Award Committee: The Scientific Achievement Award Committee shall consist of six members, of whom two shall be appointed each year by the Executive Board; and the term of each member shall be three years or until his successor has been appointed and installed. No member shall serve consecutive terms. The Committee shall select its own Chairman and Secretary. It shall select the William Blum Lecturer under the provisions of the Appendix, Section "SCIENTIFIC ACHIEVEMENT AWARD."

Section 10. Employment Committee: The Employment Committee shall consist of the Secretaries of all Branches. The Executive Secretary shall be Chairman. The Committee shall assist employers to secure qualified members of the Society for positions in the industry and shall assist unemployed members to secure employment.

Section 11. Public Relations Committee: The Public Relations Committee shall consist of nine members of the Society and the Executive Secretary. Of the nine members of the Society, three shall be appointed each year by the Executive Board, and the term of each member shall be three years or until his successor has been appointed and installed. No such member shall be appointed to the Committee for more than two consecutive terms. Upon its annual organization, the Committee shall select its Chairman and Secretary. Under the supervision of the Executive Board, the Public Relations Committee shall foster for the Society all possible public relations tending to promote the object of the Society. It shall operate under its own By-Laws when certified by the Law Committee and approved by the Executive Board.

Section 12. Editorial Board: The Editorial Board shall consist of ten members and the Executive Secretary, who in his capacity of Managing Editor of the official journal shall be Chairman. One member shall be appointed by the Host Branch of each Annual Convention and shall hold office for the year terminating at that Convention. Of the nine remaining members, three shall be appointed each year by the Executive Board on nomination by the Editorial Board, and the term of each such member shall be three years or until his successor has been appointed and installed. No member shall be appointed for consecutive three-year terms.

The Editorial Board shall be responsible for the Educational Sessions at Annual Conventions and shall assist the Managing Editor of the official journal in the determination of policy and the procurement of material.

Section 13. Publications Committee: The Publications Committee shall consist of nine members of the Society and the President. Of the nine members of the Society, three shall be appointed each year by the Executive Board, and the term of each such member shall be three years or until his successor has been appointed and installed. No member shall be appointed to the Committee for more than two consecutive terms. Upon its annual organization, the Committee shall select its Chairman and Secretary.

This Committee shall collect and review all material published by the Society to determine that which should be published in book form.

It shall operate under its own By-Laws when certified by the Law Committee and approved by the Executive Board.

Section 14. Honorary Membership Committee: The Honorary Membership Committee shall consist of four members of the Society of whom two shall have been Presidents of the Society and the remaining two shall be Delegates or Alternates who have answered roll calls at Annual Meeting for five or more years. One member of each group shall be appointed each year by the Executive Board, and the term of each member shall be two years or until his successor has been appointed and installed. Upon its annual organization, the Committee shall select its Chairman and Secretary. In case of a tie vote the President of the Society shall cast a deciding ballot.

Upon receipt from the Executive

Secretary of Branch nominations for Honorary Membership, the Committee shall review the qualifications of each nominee under the rules published in the Appendix of these By-Laws and shall report its findings to the Executive Board before January 1 of the following year.

Article IV. Funds

Section 1. General Fund: All income of the Society other than hereinafter specified shall be held in the General Fund.

Section 2. Special Funds: All monies collected for special purposes shall be held by the Executive Secretary in separate accounts. Such monies shall not be expended except for the specified purposes unless by majority vote of the Supreme Society.

Section 3. Research Fund: All income received from Sustaining Memberships, after deduction of Per Capita Tax, and all other monies specifically designated for research shall be held by the Executive Secretary in the Research Fund and shall be expended only under direction of the Research Committee.

Article V. Dues

Section 1. Collection: Dues shall be paid in advance for the fiscal year and are payable on the first of July. Dues are payable annually in one installment, except that a member elected during the fiscal year shall pay only for the complete quarters remaining of that year.

Members of Branches shall pay dues to the Branches. The Executive Secretary shall be responsible for collection of dues from Members-at-Large and Sustaining Members.

Section 2. Suspensions: A member for whom Per Capita Tax has not been paid on September 1 for the fiscal year beginning July 1 of the same calendar year shall be considered suspended until said tax shall be paid and shall not receive the official journal or other publications of the Society during suspension.

Section 3. Per Capita Tax: From the annual dues there shall be paid a Per Capita Tax of seven dollars and fifty cents ($7.50) for each Active Member in good standing of a North American Branch and of five dollars and seventy cents ($5.70) for each such member of an Australian Branch. The tax shall be paid annually, not later than the first day of September; except that for each new member of a Branch there shall be paid upon his election a tax proportionate to the number of complete quarters remaining of the fical year. If a Branch tax remains unpaid after thirty days from due date, Executive Secretary shall demand payment in writing, and if the tax remains unpaid after the thirty days following such demand, the Branch shall be considered not in good standing and its members shall not receive any benefits or publications of the Society until the said tax is paid. A Branch whose tax for any fiscal year shall remain unpaid thirty days after the beginning of the following fiscal year may by action of the Executive Board be suspended, and persistent failure to pay shall be grounds for revoking a Branch Charter by the Supreme Society.

Section 4. Special Per Capita Tax: The Supreme Society may by two-thirds vote of all delegates assess a Special Per Capita Tax upon the Society; but the total of such Special Per Capita Taxes shall not in any fiscal year exceed 10 per cent of the established minimum dues.

Article VI. Meetings and Conventions

Section 1. Place: The Annual Convention shall be held at a place selected by the Delegates at a previous Annual Meeting. Invitations from Branches shall be announced at the Annual Meeting. When two or more Branches present invitations, selection shall be by roll call vote. In the event of no invitation, or if for valid reason the place must be changed, the Executive Board shall select a suitable place with the consent and cooperation of a Branch or Branches.

Section 2. Order of Business: The Regular Order of Business of the Annual Meeting shall be that published in the Appendix to these By-Laws and shall not be suspended except by two-thirds vote of the Delegates present and voting.

Section 3. Alternates: The proxy of any Delegate may be exercised on the floor of a meeting by any duly accredited Delegate of his Branch. A Branch may cast a number of votes equal to the number of its duly accredited Delegates provided that it has one such Delegate (or accredited Alternate) present on the floor.

Section 4. Privilege of the Floor: The President or presiding officer, by unanimous consent, may grant the floor of an Annual Meeting to any person.

Section 5. Parliamentary Authority: Robert's Rules of Order shall be the parliamentary authority of the Society in all matters not especially covered in the Constitution and By-Laws or in special enactments of the Society.

Section 6. Convention Committee: The Convention Committee shall consist of members of the Host Branch and the Executive Secretary. It shall conduct the business of the Convention. At least ten months before the Convention it shall submit to the Executive Board for approval a plan for the Convention, including any proposed exhibits. At least four months before the Convention, it shall submit to the Executive Board for approval its final plans and budget. The Registration Fee of the Convention shall be determined by the Host Branch with the approval of the Executive Board.

Section 7. Finance: The Executive Secretary shall arrange for audit of all accounts and approve all financial arrangements. The Society shall be financially responsible for any deficit. All monies collected in connection with the Convention, by any means whatsoever, shall be available to defray the expenses of the Convention and associated enterprises. Any profit accruing after payment of all expenses shall be divided 50 per cent, but not more than one thousand dollars ($1,000), to the Host Branch and the remainder to the Society. Final audit shall be submitted to the Executive Board within ninety days after the Convention, and all sums due the Society shall be paid within that time.

Section 8. Exhibits: The Executive Board may at its discretion recommend to the Convention the date and place of an exhibit of manufacturers' products and of the accompanying Annual Convention. At any Annual Convention, exhibits by Branches or individual members of the Society may be invited or authorized at the discretion and under the direction of the Executive Board.

Section 9. Interim Meetings: There shall be an annual Interim Meeting of the Supreme Society, at a time and place selected by the Supreme Society, for the purpose of hearing reports and proposals, of considering all matters referred to it by the Annual Meeting, and of making recommendations to the Annual Meeting and the Executive Board concerning these and other matters which may come before it. No action of any Interim Meeting shall be binding on the Society.

PART II. BRANCHES

Article I. Authority

A Branch shall operate in accordance with its Charter and with this Constitution and By-Laws. Within the provisions of the said Charter, Constitution, and By-Laws, a Branch shall conduct its own business as it sees fit under such By-Laws as it may establish.

Each Branch shall file with the Executive Secretary copies of its By-Laws and of any amendments thereto.

Article II. Meetings

Section 1. Time and Place: The Branch shall hold regular meetings on stated days at a time and place approved by a majority of the members.

Section 2. Object: The Regular Meetings shall provide for the presentation and discussion of papers on electroplating or allied subjects and for the transaction of any business that may be brought before the meeting in furtherance of the object of the Society.

Section 3. Special and Regional Meetings: A Branch may hold special meetings and join in regional meetings under the provisions of its own rules.

Article III. Duties of Branches

Section 1. Membership Applications: The Branch shall keep a record of the names of all applicants for membership. It shall establish a Board of Managers or other board which shall review the record of each applicant and approve or disapprove his election.

Section 2. Branch Supplies: The Branch shall use standard forms of application blank, membership card, certificate, Constitution of the Society, and such other matter as may be designated by the Executive Board.

Section 3. Reports: Within seven days of each meeting the Branch shall forward to the Executive Secretary a report of the meeting and copies of all appropriate papers offered for publication by the Society.

Article IV. Organization

Section 1. Officers: The Officers of a Branch shall be President, First Vice President, Second Vice President, Secretary, Treasurer (or Secretary-Treasurer), Librarian, and the three or more members of the Board of Managers.

Section 2. Qualifications: Any member of a Branch who is in good standing may be elected an officer.

Section 3. Election and Term: Officers shall be elected by such procedure as the Branch may establish and shall hold office for one year, or until their successors have been elected and installed.

Article V. Duties of Officers

Section 1. President: The Branch President shall preside at all meetings, preserve order, put all proper motions before the meeting if duly seconded, and decide all questions of order subject to appeal to the meeting. He may cast the deciding vote in case of a tie. He shall in honor of his office be a member of all committees. He shall appoint all committees not otherwise provided for. In the absence of any officer he shall appoint a member to act in his place. He shall call all necessary meetings of the Board of Managers.

Section 2. First Vice President: The First Vice President shall perform the duties of the President in the event of absence, death, or resignation of the President. He shall have charge of promoting the growth of the membership of the Branch and shall perform such other duties as may be properly assigned him.

Section 3. Second Vice President: The Second Vice President shall perform the duties of the First Vice President in the event of absence, death, or resignation of the First Vice President. He shall perform such other duties as may be properly assigned him.

Section 4. Secretary: The Secretary shall keep accurate record of all meetings of the Branch and within seven days of each meeting shall forward to the Executive Secretary a record of the meeting and copies of all appropriate papers offered for publication by the Society. He shall receive, record, and transmit for review to the Board of Managers the applications of prospective members. He shall by July 15 file with the Executive Secretary a correct list of Branch members in good standing on June 30 and shall notify the Executive Secretary monthly of any changes and additions. He shall be a member of the Employment Committee of the Society. He shall conduct the correspondence of the Branch. He shall maintain a supply of standard forms of the Society. He shall keep itemized account of the receipts and expenditures of his office and perform such other duties as may be properly assigned him. He may be paid such compensation as the Branch shall approve.

Section 5. Treasurer: The Treasurer shall receive all funds of the Branch and deposit them as directed by the Branch. He shall pay all bills properly presented for payment under the laws of the Branch and shall sign all checks. He shall give receipt for all monies received and shall keep books of account correctly posted and ready for audit. If unable to attend any meeting of the Branch, he shall arrange for a competent deputy. He shall be bonded in a sum not less than the total of funds in his charge. He may be paid such compensation as the Branch shall approve.

Before the first day of September the Treasurer shall remit to the Executive Secretary of the Society the Per Capita Tax due for each member of the Branch; and he shall subsequently remit upon the election of a new member a Per Capita Tax proportionate to the number of quarters remaining of the fiscal year. He shall remit to the Executive Secretary the proceeds of any duly levied Special Per Capita Tax.

Section 6. Librarian: The Librarian shall provide for suitable topics of discussion, speakers, and papers for the meetings of the Branch. He shall have charge of the Question Box and of all magazines, books, and similar property of the Branch. He shall ordinarily be a representative of the Educational Committee of the Society.

Section 7. Board of Managers: The Board of Managers shall conduct the ordinary business of the Branch, referring appropriate items to the Branch. It shall supervise the property and expenditures of the Branch and shall be a standing committee for consideration of any matters referred to it. It shall examine the records of all applicants for membership and recommend to the Branch the election or rejection, as the case may be, of each.

Section 8. Property: An officer holding property of the Branch shall surrender the said property upon installation of his successor or demand of the Board of Managers.

Section 9. Reports: Every officer shall at the end of his term of office or upon his resignation submit a written report of his official transactions.

Section 10. Resignations and Vacancies: An officer intending to resign shall so notify the Branch President in writing at least one month before the effective date of his resignation. A vacancy in any office shall be filled by the Branch at the first regular meeting after occurrence of said vacancy.

Article VI. Duties of Members

Section 1. Voting: Every member shall vote when required to do so by the presiding officer of a Branch meeting.

Section 2. Misuse of Membership: No member, be he Branch member or Member-at-Large, shall use, or sanction the use of, the name or insignia of the Society or his membership in the Society or Branch in the advertising of any product or service. Violation of this provision shall be grounds for expulsion from the Society.

Article VII. Representation

Section 1. Delegates: Each Branch shall be entitled to three Delegates in the Supreme Society, who shall be members in good standing of the Branch and shall be elected by the Branch to take office at the first regular Branch meeting following the Annual Meeting of the Supreme Society. Alternates may also be elected, who may exercise the proxies of Delegates in the absence of the Delegates. Any Branch member holding national office shall automatically be one of the three Delegates of his Branch. The President and Secretary of the Branch shall certify credentials of Delegates and Alternates and shall forward copies of the said credentials to the Executive Secretary so as to reach him by not later than the first Monday in November. Delegates shall serve until their successors are duly elected and accredited. Delegates and Alternates, immediately upon their accreditation, shall be provided with a booklet by the Executive Secretary describing the duties of Delegates. This booklet, to be printed by the National Office, shall contain that section of duties of Delegates from the Branch Officers Manual.

A Branch may be represented at the Annual Meeting by proxies exercised by Delegates of another Branch; provided

that no Branch shall exercise the proxies of more than one other Branch. The said proxies shall be in force only during the Annual Meeting for which they are issued, after due presentation to the Credentials Committee and acceptance by the Delegates.

Section 2. Instruction: A Branch may instruct its Delegates in regard to their votes on the agenda of the Society and the election of Officers, and the Delegates shall vote as instructed for such period as the Branch may direct.

Article VIII. Dues

Section 1. Amount: The minimum annual dues of Active Members of North American Branches shall be seven dollars and fifty cents ($7.50) and of Australian Branches five dollars and seventy cents ($5.70). The minimum annual dues of Student Members shall be five dollars ($5.00). New members shall on election pay dues for the complete quarters remaining of the fiscal year during which they are elected.

Section 2. Expulsion: Members whose dues for the previous fiscal year are not paid at the end of any fiscal year may be expelled on recommendation of the Board of Managers and majority vote of the Branch. Such members may be again received into membership only upon due application accompanied by Application Fee and further payment of arrears acceptable to the Board of Managers.

Section 3. Transfer: No member shall transfer from one Branch to another unless he is in good financial standing.

PART III. REVISION

These By-Laws or any part thereof may be repealed, altered, annulled, suspended, or amended by two-thirds vote, either at an Annual Meeting by roll call or by letter ballot.

APPENDIX

ANNUAL MEETING

Order of Business

Opening of Convention: Chairman, Convention Program Committee
Address: President, Host Branch
Addresses: Guest Speakers and Others
Final Address of Opening: President of the Society
Turning-Over of Convention to President of the Society: Convention Chairman
Call to Order
Seating of Delegates in Reserved Sections
Roll Call of Officers
Roll Call of Delegates
Introduction of Distinguished Guests
Memorial to Deceased Members
Report of Credentials Committee, Action on Report and Appeals Therefrom
Report of the President
Reports of Vice Presidents
Report of Executive Secretary
Report of Chairman, Research Committee
Report of Secretary-Treasurer, Research Fund
Reports of Standing and Special Committees
Appointment of Election Committee
Appointment of Standing Committees
Presentation and Reading of Proposed Revisions of Constitution and By-Laws

Final Business Session

Roll Call of Officers
Roll Call of Delegates
Report of Audit of Books
Report of Paper Awards Committee
Report of Law Committee
Action on Proposed Revisions of Constitution and By-Laws
Report of Budget Committee
Action on Budget
New Business
Report of Resolutions Committee
Nomination and Election of Officers
Selection of Place of Convention
Adjournment

PAPER AWARDS

1. *Committee on Paper Awards:* The committee on Paper Awards shall consist of not less than three nor more than five members and shall be separate and distinct from the Committee on Exhibit Awards. No two members of the committee shall be members of any one Branch. The Chairman of the Committee shall be appointed by the President within 60 days from the adjournment of the Convention. The other members of the committee shall be appointed by the President from a panel submitted by the Chairman. This panel shall contain the names of twice the number of members to be appointed.

2. *Awards:* The following paper awards may be made:

(a) The Carl E. Heussner Award, consisting of the AES Gold Medal, $250, and an award certificate, for the best paper printed in Society publications during the fiscal year. (Co-sponsored by the Society and United Platers' Foundation, Glen H. Friedt, Trustee.)

(b) The AES Silver Medal for the second best Plating or convention paper during the fiscal year. Cash award: $150.

(c) The AES Bronze Medal for the third best Plating or convention paper during the fiscal year. Cash award: $50.

(d) The George B. Hogaboom Memorial Award, consisting of $75.00 and an Award Certificate, for the best paper on nickel plating printed in Society publications during the fiscal year. (Co-sponsored by the Society and the Hartford Branch.)

(e) The Robert S. Leather Mechanical Finishing Award of the American Electroplaters' Society, sponsored by the Lea Manufacturing Company and consisting of $50.00 and a certificate, for the best paper on the subject of mechanical finishing appearing in Society publications during the fiscal year.

(f) The Chromium Plating Award of the American Electroplaters' Society, sponsored by the Nutmeg Chrome Corporation and consisting of $50.00 and a certificate, for the best paper on the subject of chromium plating appearing in Society publications during the fiscal year.

(g) The Precious Metal Plating Award of the American Electroplaters' Society, sponsored by Technic, Inc., and consisting of $50.00 and a certificate for the best paper on the plating of gold, rhodium, platinum, palladium and silver appearing in Society publications during the fiscal year.

(h) The John J. Hanney Memorial Award consisting of $75.00 and an Award Certificate, for the best paper on copper plating printed in Society publications during the fiscal year. (Co-sponsored by the Society, its Grand Rapids Branch and the Metal & Thermit Corporation.)

3. *General Consideration for Awards:*

(a) The author of any paper which merits one or more of the Society's paper awards may be any person, not necessarily a member of the Society.

(b) At least three papers in each category should be available for judging. In any year when less than that number of qualifying papers have been published, it or they are to be held over until at least three accumulate in the succeeding year or years.

(c) When a single paper has more than one author, duplicate medals and/or certificates are to be presented to each author. The cash award, however, will remain unchanged and will be equally divided among the respective winning authors.

(d) If in the judgment of the Paper Awards Committee those papers whose subject matter makes them eligible for any of the special awards, (e), (f), (g) or (h) above, have insufficient merit to deserve the award, the Committee shall announce that no award of (e), (f), (g) or (h) is made for that year. The decisions of the Committee on Paper Awards shall be final.

(e) In judging a paper for an award, the Committee shall completely disregard the

author's affiliation, except that no award shall be given for AES Research Reports and no member of the Paper Awards Committee shall be eligible for award.

(f) Papers presented before a Branch during one fiscal year but printed in a Society publication during a following fiscal year, shall be classified in the year in which publication occurs. A paper appearing serially in two or more issues shall be judged in that fiscal year in which the final part is published.

(g) Papers which have received prior presentation before other societies or prior publication outside the publications of the AES shall be considered ineligible for competition. This shall include rewrites of such papers unless the rewrite shall contain new material, in which case the new material shall be eligible for consideration.

4. *Specific Considerations for Award:* In judging eligible papers, the Committee shall use a point system, and, for each award made, the paper receiving the highest number of points shall receive the award. The following considerations and maximum number of points shall apply:

(a) Immediate value to the electroplating industry.....30

This shall be measured by such considerations as:

(1) Its money-saving worth in pointing out economies in existing process
(2) Improvement on existing process
(3) Simplification of control of process or of measurement of quality of product
(4) Novel theoretical considerations leading to a more complete understanding of process
(5) New process for an existing product
(6) New product

(b) Scientific value.....30

This classification is intended to reward papers that appear to have enduring future value, although they might be of small immediate practical value. A paper may receive a high rating under both (a) and (b).

(c) Originality of subject matter or value as a review paper.....30

A paper which is purely a review paper shall be rated as such on the basis of whether the review is of sufficient scope and is so presented as to be of considerable value to a large number of members.

(d) Clarity of presentation.....10

The principal emphasis shall be on presentation of subject matter in a clear understandable manner. Extensive plots, photomicrographs, etc., do not necessarily add to clarity of presentation. The length of the paper shall be considered immaterial.

5. *Announcement of Awards:* The announcement of paper awards shall be made by the Chairman of the Paper Awards Committee at the final business session of the Annual Convention following the close of the fiscal year. Presentation of the awards shall be made during the Annual Dinner, or Banquet, at the Convention, and winners of awards shall be requested in advance to be present.

6. *Report of the Paper Awards Committee:* As soon as possible after the close of the fiscal year, the Chairman shall report to the President of the Society the winners of awards during the fiscal year past. The President shall then instruct the Executive Secretary to prepare the various awards for presentation.

SCIENTIFIC ACHIEVEMENT AWARD

Purpose and History

The Scientific Achievement Award was instituted by the American Electroplaters' Society for the purpose of recognizing Society members whose outstanding scientific contributions have advanced the theory and practice of electroplating, metal finishing, and allied arts; have raised the quality of processes and products; or have enhanced the dignity and status of the profession. The award winner will deliver the William Blum Lecture, so named to honor Dr. William Blum, who through his active association with our technical programs contributed greatly in gaining international recognition for the Society as a forum for the discussion of theoretical and practical aspects of electroplating. The lecture was established in 1957. The names of the Scientific Achievement Award Committee members shall be published in the Annual *Technical Proceedings* or its equivalent.

Rules Governing Selection of Lecturer

The Lecturer shall be selected by the Scientific Achievement Award Committee prior to the annual Convention one year preceding presentation of the lecture.

On September 1 preceding the Lecturer's selection the Executive Secretary shall poll the Supreme Society Delegates of Branches in good standing on that date for first and second choice nominations for the award. Each Delegate polled shall be furnished complete information regarding the award and selection of the Lecturer. Nominations shall be closed on October 15. Each nomination shall be accompanied by six copies of a dossier of accomplishments that, in the opinion of the Branch, entitles the candidate to Scientific Achievement Award consideration.

The Executive Secretary shall furnish the Scientific Achievement Award Committee Chairman the names of all nominees by November 1.

The Chairman shall forward the nominees' names with supporting information to the Committee Members by November 15. Each member shall report his choice (if any) to the Chairman by December 15. The Chairman shall re-list the names of all nominees receiving one vote (six names at most) and re-poll the members who shall report their choice (if any) by February 1. The Lecturer is chosen if one nominee receives 4 or more votes. If no nominee receives four votes, a third poll on nominees receiving two or three votes shall be completed by March 1.

The Chairman shall before April 1 furnish the name of the Lecturer and suggest the wording to be inscribed on the scroll to the President, or inform him that none of the nominees had sufficient merit to deserve the award. The identity of the winner shall be kept in confidence until the following Annual Convention. The President shall at that time announce the winner. The decision of the Scientific Achievement Award Committee shall be final.

Requirements and Awards

The lecturer shall be a member of the Society with at least 10 years of recognized achievements related to the purpose of the Award. He shall deliver a lecture related to the purpose of the Award during the second technical session of the Annual Convention following that at which his selection was announced. (The Educational Chairman of the Host Branch shall arrange for a single session at the time of the lecture if multiple technical sessions are offered.) Immediately following the lecture, the Lecturer shall receive a cash honorarium of $500.00 (Five Hundred Dollars) and a suitably inscribed scroll. The lecture shall be published in the Annual *Technical Proceedings* or its equivalent. A list of the William Blum Lecturers and the subjects presented shall be published annually in the Annual *Technical Proceedings* or its equivalent.

Provisions for Award

The Executive Secretary shall provide a scroll inscribed with the name of the Lecturer, the field covered by the lecture, the place and the date of its delivery, signed by the President and members of the Scientific Achievement Award Committee. The cash honorarium shall be provided from the Society's General Fund.

AWARD OF HONORARY MEMBERSHIP

Honorary Membership may be conferred by majority vote of the Supreme Society in Annual Meeting, after nomination by a Branch, review by the Honorary Membership Award Committee, and approval by the Executive Board, upon a member of the Society who has achieved eminence in its field of work or has rendered especially meritorious service to the Society. Qualification for election shall be determined under the Basis of Award which follows below.

On September 1 of each year, the Executive Secretary shall poll the Delegates for Branch nominations. Any nominations offered shall be accompanied by six copies of a statement of qualifications under the Basis of Award. Nominations shall be closed on November 15.

The Executive Secretary shall transmit all nominations and covering statements of qualifications to the Honorary Membership Awards Committee, which shall review the statements and report its findings before February 1 to the Executive Board. In case of a tie, the President of the Society shall cast a deciding ballot.

The Board shall review the report and shall approve for balloting such nominations as it finds properly supported, and these shall be voted upon under New Business at the next Annual Meeting. The nominating Branch shall be notified of any approval and shall have the privilege of presentation of the nominee's name through a Delegate. Not more than three Honorary Memberships shall be elected in any year. No member shall be nominated to Honorary Membership while a member of the Executive Board or a paid employee of the Society.

BASIS OF AWARD

Honorary Membership may be granted annually provided there is a qualified nominee.

The number of Honorary Memberships granted in any one year shall not exceed one per 2,500 members or a fraction thereof.

To qualify, a nominee must have served the National Society with distinction. In considering nominations, the Branch Delegate and Honorary Membership Award Committee shall be guided by the nominee's activities along the following lines:

1) Service as a Delegate to the Supreme Society.

2) Authorship of papers published in Society publications.

3) Service in staging national conventions.

4) Service as a national officer.

5) Chairmanship of committees or boards established by the Executive Board or Supreme Society.

6) Service on committees or boards established by the Executive Board or Supreme Society.

7) Work in organizing and presenting courses in electroplating and metal finishing.

8) Active assistance in organizing a new branch.

9) Outstanding representation of the Society with closely allied groups.

10) Any other distinguished service or contribution to the Society.

PUBLICATION

A list of all Honorary Members of the Society shall be published annually in the Annual Proceedings or its equivalent.

CHARLES HENRY PROCTOR MEMORIAL LEADERSHIP AWARD

1. That the Award shall be exclusively sponsored by Mr. and Mrs. William O. Preston of 34 Lewis Drive, Madison, New Jersey—son-in-law and daughter respectively of the late Charles Henry Proctor.

2. That it shall be designated and hereafter exclusively known as the "CHARLES HENRY PROCTOR MEMORIAL LEADERSHIP AWARD."

3. That it shall be awarded annually to that member in good standing of the American Electroplaters' Society, Inc. (AES), regardless of whether or not a National, Branch or Committee Officer, who during the year, in the judgment of the Selection Committee, demonstrated the most outstanding leadership qualities among nominees by AES Branches and AES Committees, in furthering the objectives of the Society or enhancing its dignity, prestige or progress. Said qualifications, for judging by the Selection Committee, shall be documented as to specific act or acts, whether organizational, administrative, membership promotion, public relations, educational, management or other such elements, singly or collectively.

4. That the annual Award shall consist of a cash award of $150—plus a suitably inscribed and laminated Scroll—plus suitable recognition in PLATING MAGAZINE and in TECHNICAL PROCEEDINGS. Presentation of said Award shall be formally made at the Banquet of the National Convention by the donor if present otherwise by the President of the Society.

5. That nominations for said Award shall be made by AES Branches and AES Boards and Committees by not later than April 1 annually.

6. That the Selection Committee shall be composed of a) Mrs. William O. Preston, the donor, b) the President of the Society, c) the National Executive Secretary of the Society, d) the Chairman of the Order of Past Presidents, e) the Chairman of the Research Committee and f) two Branch Presidents to be selected annually by the Executive Board at its June meeting. Each member of the Committee shall have one vote. Any four affirmative votes shall constitute selection. Selections may be made at a meeting of the Committee or by Letter Ballot. The President of the Society shall be Chairman of the Committee.

7. That the donor shall be billed for a) the cash award ($150) and b) the cost of inscription and lamination of the Scroll, at cost, by National Headquarters not later than one month after the year's selection. In no case shall the aggregate annual expense to the donor exceed $200. In addition, the donor will bear the one-time, non-recurring cost of designing and publishing a stock of scrolls at an expense, at cost, not to exceed $50.

8. That the donor can terminate this Award at will by written notice to the National Executive Secretary one year in advance of desired terminal date.

FINANCIAL REPORT

FOR THE TWELVE-MONTH FISCAL PERIOD JULY 1, 1958—JUNE 30, 1959

AMERICAN ELECTROPLATERS' SOCIETY, INCORPORATED
NEWARK 2, NEW JERSEY

We have examined the balance sheets of the General Fund and Research Fund of American Electroplaters' Society, Incorporated (New Jersey Corporation) as of June 30, 1959, and the related statements of income and principal for the year then ended. Our examination was made in accordance with generally accepted auditing standards, and accordingly included such tests of the accounting records and such other auditing procedures as we considered necessary in the circumstances.

The accompanying balance sheets and statements of income are exclusive of certain accounts described in the notes appended thereto.

In our opinion, the accompanying balance sheets and statements of income, except as indicated above, present fairly the financial position of American Electroplaters' Society, Incorporated at June 30, 1959, and the results of its operations for the year then ended, in conformity with procedures generally followed by similar organizations, on a basis consistent with that of the preceding year.

Newark, New Jersey
July 17, 1959

CLYDE A. ZUKSWERT & CO.
Certified Public Accountants

FINANCIAL STATEMENT OF THE SUPREME SOCIETY OF THE AMERICAN ELECTROPLATERS' SOCIETY, INC.

EXHIBIT A

Comparative Balance Sheet—General Fund—June 30, 1959 and 1958

ASSETS	June 30, 1959 "Society" Control	June 30, 1959 "Plating" Control	June 30, 1959 Total	June 30, 1958	Increase Decrease*
CURRENT ASSETS:					
Demand deposits	$ 3,066.24	$11,856.64	$ 14,922.88	$ 46,953.36	$32,030.48*
Petty cash	50.00		50.00	50.00	
United States Treasury Bonds:					
$10,000.00 Series K (redemption value)	9,700.00		9,700.00	9,660.00	40.00
$15,000.00 3¼%, 6/15/83-78 at cost (market value $13,096.88)	15,682.20		15,682.20	15,682.20	
Time deposits	110,000.00		110,000.00	110,000.00	
Accounts receivable:					
Advertising, books, reprints, supplies and miscellaneous	176.84	5,036.30	5,213.14	6,221.19	1,008.05*
Advances, conventions and exhibitions				2,137.30	2,137.30*
Due from Research Fund				1,341.33	1,341.33*
Accrued interest receivable	762.50		762.50	243.75	518.75
Prepaid expenses	473.25	5,640.37	6,113.62	6,811.10	697.48*
Total current assets	$139,911.03	$22,533.31	$162,444.34	$199,100.23	$36,655.89*
CONTRA ACCOUNTS:					
Due from "Society" control	$	$57,322.36	$	$	$
Due to "Plating" control	(57,322.36)				
DEPOSIT, AMERICAN AIRLINES	$ 425.00		$ 425.00	$ 425.00	$
CARL E. HEUSSNER AWARD FUND:					
Fidelity Federal Savings and Loan Association, Glendale, California	$ 3,000.00	$	$ 3,000.00	$ 3,000.00	$
Total assets	$ 86,013.67	$79,855.67	$165,869.34	$202,525.23	$36,655.89*
LIABILITIES AND PRINCIPAL					
CURRENT LIABILITIES:					
Accounts payable	$	$ 5,291.23	$ 5,291.23	$ 6,331.01	$ 1,039.78*
Accounts receivable credit balances		8.00	8.00	8.00	
Foreign advances	12.65		12.65	22.55	9.90*
Exchanges and advances				6.50	6.50*
Accrued expenses		79.55	79.55	84.82	5.27*
Due to Research Fund				1,920.27	1,920.27*
Deferred income		196.00	196.00	7,997.70	7,801.70*
Total current liabilities	$ 12.65	$ 5,574.78	$ 5,587.43	$ 16,370.85	$10,783.42*
CARL E. HEUSSNER AWARD FUND	$ 3,262.79	$	$ 3,262.79	$ 3,153.49	$ 109.30
GENERAL FUND PRINCIPAL, EXHIBIT D	$ 82,738.23	$74,280.89	$157,019.12	$183,000.89	$25,981.77*
Total liabilities and principal	$ 86,013.67	$79,855.67	$165,869.34	$202,525.23	$36,655.89*

NOTE: The above comparative balance sheet does not include inventories of publications, literature and supplies, office furniture and equipment.

EXHIBIT B

STATEMENT OF INCOME
GENERAL FUND—"SOCIETY" CONTROL
For the year ended June 30, 1959

	Annual Budget	Actual
INCOME:		
Per Capita Tax and Dues (Pro rata share):		
Members	$19,000.00	$18,937.87
Members-at-large	1,404.00	1,644.02
Sustaining members	800.00	784.35
Publications, etc.:		
Technical "Proceedings"	3,000.00	3,907.00
Books, other society publications	3,000.00	4,108.18
Branches:		
Membership insignia, etc. sold	200.00	824.51
Other Income:		
Mailing services	3,000.00	576.28
Interest on investments	5,000.00	5,641.00
Miscellaneous income		29.07
Total income	$35,404.00	$36,452.28
EXPENSES:		
Publications, etc.:		
Technical "Proceedings"	$16,500.00	$14,869.90
Books, other society publications	2,500.00	3,044.35
Mailing services	1,000.00	457.14
Headquarters—Personnel:		
Staff salaries (Pro rata share)	19,950.00	19,083.42
Social security and hospitalization	625.00	521.68
Travel	2,334.00	1,897.17
Headquarters—Office:		
Office expenses (Pro rata share)	6,050.00	5,892.69
Furniture and equipment (Pro rata share)	866.00	207.89
National officers:		
Travel	4,500.00	1,726.21
Supplies	100.00	
Awards, convention meetings, memberships, manuals, Proceedings, reporters, etc.	5,715.00	4,861.08
Christmas fund	375.00	362.99
Interim meeting	1,250.00	913.40
Committee meeting expense	750.00	413.57
Branch supplies	900.00	692.84
Total expenses	$63,415.00	$54,944.33
EXCESS EXPENDITURES OVER INCOME	$28,011.00	$18,492.05

NOTE: The expenses reported do not take into full account the changes during the period in inventories of publications, literature and supplies, office furniture and equipment.

EXHIBIT C

STATEMENT OF INCOME
GENERAL FUND—"PLATING" CONTROL
For the year ended June 30, 1959

	Annual Budget	Actual
INCOME:		
Advertising (except classified)	$	$153,007.00
Less:		
Discounts allowed	$	$ 2,410.70
Agency commissions		20,617.60
Total deductions	$	$ 23,028.30
Net	$173,243.00	$129,978.70
Subscriptions:		
Members (pro rata share of per capita tax)	$ 14,200.00	$ 14,030.17
Members-at-large (Pro rata share of dues)	468.00	547.16
Sustaining members (Pro rata share of dues)	700.00	581.00
Non-members	6,800.00	6,748.80
Total subscriptions	$ 22,168.00	$ 21,907.13
Sales:		
Reprints	$ 5,000.00	$ 3,486.93
Classified advertising	325.00	519.40
Miscellaneous		781.62
Total sales	$ 5,325.00	$ 4,787.95
Total income	$200,736.00	$156,673.78

EXHIBIT C (continued)

EXPENSES:		
Monthly publication expense:		
Printing costs		($ 73,049.19
Other costs	$ 82,000.00	(5,157.54
Headquarters—Personnel:		
Salaries (Pro rata share)	59,850.00	57,249.52
Social Security and hospitalization	1,875.00	1,393.74
Commissions, Advertising Manager	3,100.00	1,049.31
Travel	4,666.00	3,793.03
Headquarters—Office:		
Office expenses (Pro rata share)	12,100.00	11,465.86
Furniture and equipment (Pro rata share)	434.00	415.74
Promotional advertising and Audit Bureau of Circulation	3,500.00	2,808.57
Reprints	3,000.00	2,366.13
Total expenses	$170,525.00	$158,748.63
EXCESS OF EXPENSES OVER INCOME	$ 30,211.00	$ 2,074.85

NOTE: The expenses reported do not take into full account the changes during the period in inventories of publications, literature and supplies, office furniture and equipment.

EXHIBIT D

STATEMENT OF GENERAL FUND PRINCIPAL
For the year ended June 30, 1959

	"Society" Control	"Plating" Control	Total
BALANCE, JULY 1, 1958	$109,254.13	$73,746.76	$183,000.89
ADDITIONS:			
Collections applicable to three months ended June 30, 1958:			
Per capita tax	3,930.16	2,911.24	6,841.40
Member-at-large dues	76.48	25.49	101.97
Income from Cincinnati Convention	604.15		604.15
Total	$113,864.92	$76,683.49	$190,548.41
DEDUCTIONS:			
Excess of expenses over income for the year ended June 30, 1959, per Exhibits B and C	$ 18,492.05	$ 2,074.85	$ 20,566.90
Expended against supplementary budget for Golden Jubilee	11,997.34		11,997.34
AES Scientific Achievement Award	500.00		500.00
Exhibition equipment written off—(Convention equipment purchased prior to 1956)	137.30		137.30
Uncollectible advertising account written off		327.75	327.75
Total deductions	$ 31,126.69	$ 2,402.60	$ 33,529.29
BALANCE, JUNE 30, 1959	$ 82,738.23	$74,280.89	$157,019.12

EXHIBIT E

COMPARATIVE BALANCE SHEET—RESEARCH FUND
June 30, 1959 and 1958

	June 30		Increase Decrease*
	1959	1958	
ASSETS			
CURRENT ASSETS			
Demand deposit	$ 29,114.28	$ 28,062.50	$1,051.78
Time deposits	84,000.00	84,000.00	
Accounts receivable	8.35	1.20	7.15
Accrued interest receivable	995.00		995.00
Due from General Fund, "Society" Control		1,920.27	1,920.27*
Prepaid expenses		156.67	156.67*
Total assets	$114,117.63	$114,140.64	$ 23.01*
LIABILITIES AND PRINCIPAL			
CURRENT LIABILITIES:			
Due to General Fund, "Plating" Control	$	$ 1,341.33	$1,341.33*
Exchanges		10.00	10.00*
Total current liabilities	$	$ 1,351.33	$1,351.33*
RESEARCH FUND PRINCIPAL, EXHIBIT G	$114,117.63	$112,789.31	$1,328.32
Total liabilities and principal	$114,117.63	$114,140.64	$ 23.01*

STATEMENT OF INCOME—RESEARCH FUND

EXHIBIT F — **For the year ended June 30, 1959**

	Annual Budget	Actual
INCOME:		
Sustaining membership dues and subscriptions (Pro rata share)	$30,000.00	$27,684.65
Per capita tax (Pro rata share)	7,000.00	7,015.07
Member-at-large dues (Pro rata share)	200.00	273.60
Sale of reprints	400.00	688.20
Interest on investments	3,000.00	3,255.00
Branch contributions	200.00	110.15
Research Fund reserves	6,700.00	6,700.00
Total income	$47,500.00	$45,726.67
EXPENSES:		
Transfer to Canadian Research Fund	$	$ 6,400.00
Exchange		168.50
Project payments to directors and institutions	43,377.00	31,395.15
Reprint purchases	723.00	156.67
Social Security tax	125.00	118.17
Travel expenses	125.00	142.73
Sustaining membership promotion and certificates	400.00	313.38
Miscellaneous expense including postage	1,000.00	698.34
Office expense	1,500.00	1,500.00
Audit and contingency	250.00	137.96
Total expenses	$47,500.00	$41,030.90
EXCESS INCOME OVER EXPENSES		$ 4,695.77

STATEMENT OF RESEARCH FUND PRINCIPAL

EXHIBIT G — **For the year ended June 30, 1959**

BALANCE, JULY 1, 1958		$112,789.31
ADDITIONS:		
Collections applicable to three months ended June 30, 1958:		
Per capita tax		$ 1,455.62
Member-at-large dues		12.75
Refund, project number five, Michigan State University		2,531.66
Excess of income over expenses for the year ended June 30, 1959, per Exhibit F		4,695.77
Total		$121,485.11
DEDUCTIONS:		
Appropriation to current budget	$6,700.00	
Expended against $2,500.00 supplementary budget for Golden Jubilee	667.48	
Total deductions		7,367.48
BALANCE, JUNE 30, 1959		$114,117.63

STATEMENT OF RECEIPTS AND DISBURSEMENTS
CANADIAN RESEARCH FUND

EXHIBIT H — **For the year ended June 30, 1959**

BALANCE, JULY 1, 1958 (THE DOMINION BANK, TORONTO, CANADA)		$ 2,393.85
RECEIPTS:		
American Electroplaters' Society, Research Fund	$6,400.00	
Branch contributions	100.00	
Sustaining membership dues	1,600.00	
Interest	24.78	
Total receipts		8,124.78
Total		$10,518.63
DISBURSEMENTS:		
Ontario Research Foundation	$8,400.00	
Discount and foreign exchange	15.65	
Taxes	3.71	
Total disbursements		$ 8,419.36
BALANCE, JUNE 30, 1959 (THE DOMINION BANK, TORONTO, CANADA)		$ 2,099.27

INTERSOCIETY NEWS

FUNDAMENTAL KNOWLEDGE OF MATERIALS THEME OF ASTM MEETING

A plea for less empiricism and a more fundamental approach to materials problems ran through many of the addresses and other activities at the 62nd Annual Meeting of the American Society for Testing Materials held at Chalfonte-Haddon Hall, Atlantic City, N. J., June 21–26, 1959. In a time marked by growing realization that the problems of materials are among those most vital to the advance of technology, it was perhaps a surprise to no one that attendance at the meeting reached an all-time high—registration was a record 3133. As President Woods said in his retiring-president's address, "solving the problems of materials will be the key to success in the broader problems introduced by the space age." Highlighting the technical program were a Symposium on Education in Materials, a forum on The Place of Research in ASTM, and a Nuclear Problems Forum, the annual Marburg and Gillett Lectures on "New Polymers—New Problems" and the "Role of Dislocations in Plastic Deformation" (of metals), respectively.

Greater science-orientation in the engineering school curricula and in the engineering profession will have great impact on ASTM in the future. This was the theme of the annual President's address delivered by retiring President K. B. Woods, Head, School of Civil Engineering, Purdue University.

The retiring president concluded that ASTM must be prepared in the future to provide standards for many new materials, to expand its membership, and to provide more publication space for all segments of the Society's vast structure.

The some 40 technical sessions included many taking care of essential Society action on committee recommendations and reports. A greater part of the time devoted to technical activities, however, was spent in the presentation of symposiums and technical papers. Topics covered included concrete, radioisotopes, soil testing, fatigue, bituminous paving mixtures, the effect of temperature on metals, Atterberg limits for soils, spectroscopic excitation sources, bituminous binders, road and paving materials, aging and compression set of poly (vinyl chloride), microscopy, visual aids in testing procedures, and the identification of water formed deposits, as well as electron metallography and steel.

The main business of the Society—formulation of materials standards and test methods for industry—took place in the more than 900 meetings of technical committees and subgroups who have the gigantic task of keeping up-to-date the existing standards and devising new standards which are the backbone of commerce in materials. The responsibility of these groups to industry is to see that the constant flow of new knowledge about materials is continually reflected in these standards.

The increasing use of analytical methods involving radioisotopes and the prospects for rapid further expansion of use of such methods were dealt with in the Symposium on Radioisotopes in Metals Analysis and Testing. While the use of radioactive tracers, including isotope dilution techniques, was by no means neglected, even greater consideration was given to activation techniques in which the sample to be analyzed is irradiated and suitable measurements of the radioisotopes created in the sample made.

In the introduction to the symposium, Professor W. W. Meinke of the University of Michigan covered the principles, available techniques, capabilities, and problems involved in the use of radioisotopes in metals analysis and testing. Detailed discussions of the various types of instrumentation and techniques were presented in a paper by A. H. Emmons, also of the University of Michigan.

A general coverage of metals analysis by radioactivation techniques was given in a paper by G. H. Morrison, Sylvania Research Laboratories. Specific applications of radioactivation techniques were covered in papers by J. F. Cosgrove, Sylvania Research Laboratories; A. H. Bushey, General Electric Co.; and J. E. Lewis, Alcoa Research Laboratories.

NACE REGION CONFERENCE INCLUDES PAPERS ON CORROSION MITIGATION BY ELECTROPLATING

Two papers related to corrosion mitigation are included in the National Association of Corrosion Engineers Northeast Region Corrosion Conference to be held October 5–8 at the Lord Baltimore Hotel in Baltimore, Md.

A paper "Chromium Electroplates for Corrosion Protection of Stressed Type 410 Stainless Steel in High Temperature High Purity Water by Henry Suss, Knoll's Atomic Power Laboratory, Schenectady, New York, describes variations in results obtained with the use of chromium plate for the protection of hardened and stress relieved type 410 stainless steel against stress corrosion cracking on exposure to 300F water. Bases for the variation will be discussed.

Mr. Suss will also discuss the value of chromium plate for protecting hardened and tempered (1125F) type 410 stainless steel against pitting attack in oxygenated water.

C. Tirrel, Ionics, Inc., Cambridge, Mass. will present a paper on "Properties and Applications of Platinum Surfaced Anodes."

The electrodes are composed of films of platinum 20 to 50 microinches on titanium or tantalum valve metal. Platinum coated anodes have the electrochemical properties of platinum and can be made easily with the physical properties demanded by the application.

Thirty-five technical papers will be presented in eight symposia related to Theories and Principles of Corrosion, Marine Cathodic Protection, General Cathodic Protection, High Temperature Corrosion, Protective Coatings, Corrosion in Handling Water, Special Corrosion Topics and Corrosion Inhibitors.

Kenneth M. Huston of the AES Baltimore-Washington Branch is conference co-chairman.

CORROSION CONTROL COURSE IN MIAMI

Tentative schedule has been made for the 4th Annual General Florida Conference 1959 Corrosion Short Course to be given November 16–20, 1959 at the Key Biscayne Hotel in Miami. The course is sponsored by the Miami Section of the National Association of Corrosion Engineers.

Following is the schedule released by the course director: Monday, Missiles and aircraft; Tuesday, Cathodic protection fundamentals, rectifiers and anodes; Wednesday, Underground corrosion survey fundamentals, pipe line, lead cable and pipe type cable; Thursday, Polyvinychlorine pipe, plastisols, corrosion research, instrumentation and non-destructive testing; Friday, Coating for corrosion control, chemistry of paints, coal tar coatings, epoxy resins, coating comparison and developments.

NEW ASM OFFICERS

Walter Crafts, associate director, technology, Union Carbide Metals Co., Niagara Falls, N.Y., has been named new president of the American Society for Metals.

INDICATE A 933. ➤

LEA

ABRASIVE FINISHING METHODS

ALUMINUM and MAGNESIUM

AND THEIR ALLOYS

CASTINGS · FORMINGS · EXTRUSIONS · SPINNINGS · STAMPINGS

Aluminum and Magnesium and their alloys are soft metals with high coefficients of friction and a tendency to be cut away at the grain boundaries if overheated during an abrading operation. These characteristics limit the choice of finishing procedures to those providing sufficient lubrication and those requiring a minimum of pressure.

The objective, of course, is to use the least number of operations permitted by the hardness and original surface to arrive at the desired commercial finish. Recommendations are of necessity rather general, but it is hoped they will serve as a guide. We shall, of course, be glad to make specific recommendations on request after studying samples of work.

POLISHING...A peripheral speed of 5000 sfm is recommended for polishing Aluminum and Magnesium when glue is used to bond the abrasive to the set-up wheel. From 5000 to 7000 sfm would be satisfactory using GRIPMASTER or PLASTI-GLUE cement for bonding the abrasive to the set-up wheels. In either case, the use of bar LUBAR, Clean Grain LUBAR or LIQUALUBE, a liquid lubricant, is necessary to prevent the wheel from loading which slows down the rate of polishing and causes gouging of the surface. Polishing wheels may also be prepared using liquid abrasive-cement compositions, such as LEABRAMENT or PLASTI-BRADE. LEA COMPOUND is frequently used for polishing Aluminum and Magnesium castings with sewed buffs, canvas, felt or leather polishing wheels which have been sized or pre-coated first with bar AD-LEA-SIVE No. 3

The resultant fast-cutting flexible polishing head is top-dressed with LEAROK or LUBAR to produce a smooth metal surface free of adhering dry particles of metal. Such particles would be produced by dry abrasives without the lubrication referred to above and would result in discoloration upon subsequent treatment, such as anodizing.

INTERMEDIATE FLEXIBLE POLISHING...Small defects, flash, etc. are removed and the surface brought to a uniform finish, using a flexible polishing step with a LEA COMPOUND (such as Grade "N") on sewed buffs or loose muslin sections at 4000 to 5000 sfm.

SATIN FINISHING... This is a final finish produced at surface speeds of 3000 to 5000 feet per minute. Use LEA COMPOUND such as Grades "N", "C" or "B-31" on loose muslin buffs, ventilated or bias buffs, string or wick wheels, with or without LEAROK or LUBAR lubricant, according to the line effect desired.

MATTE FINISHING... This is also a final finish, frosted in appearance. Using Grade "C" LEA COMPOUND at 5000 sfm on ⅜" sewed buff wheels will develop the heat necessary to produce the sand blast or frosted type of finish.

BUTLER FINISHING...To produce this final finish showing no surface defects, we suggest Grade "A-1", "B-12" or "MH" LEA COMPOUND on loose muslin buffs at 3000 to 5000 sfm.

BRIGHT FINISHING (Bar Compositions)... For cutting down stampings or extrusions, use Grade 765 LEAROK, at 6000 to 7500 sfm; for coloring, follow this step with Grade 884 LEAROK at the same speed. Use loose muslin buffs for both operations. For cutting down castings, use Grade 406 LEAROK; for coloring, use Grade 309 LEAROK.

BRIGHT FINISHING (Liquid Compositions)... All operations at 6000 to 8000 sfm.

Castings & Extrusions

Heavy Cut—FH77J or UF47J Liquabrade
Cut & Color—TH52P or 4994 Liquabrade
Color—UH20A or UH20D Liquabrade
Buff—Sisal for Heavy Cut; Ventilated or Sewed for Cut and Color; Loose buff for coloring.

Stampings & Extrusions

Cut—TH52P or 4994
Color—UH20A or UH20D Liquabrade
Buffs—Ventilated or Sewed

MAGNESIUM ALLOYS

Finishing methods for magnesium and its alloys closely parallel those for aluminum except that certain magnesium alloys do not drag or tear making unnecessary as much lubrication as is usually required with aluminum. Refer to above for general procedure.

Burring, Buffing, Polishing, Lapping, Plating and Spray Finishing . . . Manufacturers and Specialists in the Development of Production Methods, Equipment and Compositions. Manufacturers of Lea Compound and Learok . . . Industry's quality buffing and polishing compounds for over 30 years.

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Lea Mfg. Company of Canada, Ltd., 1236 Birchmount Road, Scarborough, Ontario, Canada
Lea Mfg. Company of England, Ltd., Buxton, Derbyshire, England

ABRASIVE FINISHING ALUMINUM and MAGNESIUM and their alloys

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Plating Polishing Buffing
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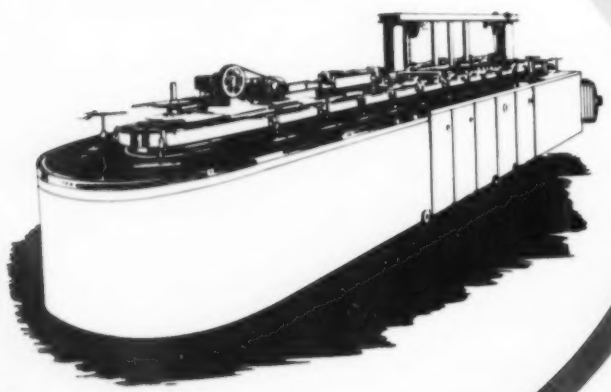
NICKEL GLEAM N222*

EXCEPTIONAL LEVELLING

without sacrificing

THROWING POWER
DUCTILITY
CHROMIUM RECEPTIVITY



Because of its versatility, N222 can be used effectively with either mechanical or air agitation... in fact, without agitation should none be available. And all this plus high tolerance to organic and metallic contamination! You can switch over to NICKEL-GLEAM N222 without changing conditions under which you prefer to operate. You will get better results. A trial run will prove it.

NICKEL-GLEAM N222 is a product of Lea-Ronal Research Laboratory widely experienced in plating procedures and responsible for some of the most productive formulations being used today.

*Patented

Lea-Ronal *Inc.*

Are you int[illegible]

SE[illegible]

Also picked by the ASM nominating committee were a new vice president, a treasurer and two trustees.

The new officers will be formally elected at the annual meeting of the 30,000-member engineering society of the metal-working industry in Chicago, November 4, during the 41st National Metal Exposition and Congress. They will take office at the conclusion of the Metal Show, November 6.

Nominated in addition to Mr. Crafts are William A. Pennington, professor of metallurgy, University of Maryland, College Park, Md., vice president; Robert J. Raudebaugh, supervisor, iron-nickel alloys, International Nickel Co., New York City, treasurer.

ETCHED CIRCUITS INSTALLS NEW OFFICERS

Dr. Paul H. Margulies, manager of the metals section at the Central Research Laboratories of Food Machinery and Chemical Corp., Princeton, N. J., has been chosen as president-elect of the Etched Circuits Society. He will serve on the Society's executive board during the coming year and will then take office as president for the following year in September 1960.

Wallace Moore, of the Sibley Company, Haddam, Conn., is the incoming president of the Society for 1959–1960, having been elected last year.

Elected along with Dr. Margulies were Edward Poltrack, of Barnes Engineering Co., Stamford, Conn., who will serve as secretary during the coming year, and Fred Yarrington, of Pettigrew & Co., West Hartford, Conn., who will be its treasurer.

The society, which aims to cover all phases of printed circuit design and production, was founded a little less than two years ago. It has grown to an organization of 55 members representing almost that many different companies.

Regular monthly meetings are held during the year, at various cities on the Atlantic Seaboard, with speakers drawn from the rapidly growing printed circuit industry. Planned for the coming year are presentations by the Signal Corps, Eastman Kodak, Rochester, N. Y., Shelton Eyelet Co., Shelton, Conn., as well as other leaders in this and associated fields.

VACUUM COATERS TO HOLD TECHNICAL MEETING

Ten technical papers are to be presented at the Third Annual Meeting of the Society of Vacuum Coaters to be held on January 26 and 27, 1960 at the Hotel Biltmore in New York City. The business meeting will be held in the afternoon of Tuesday, January 26, and the technical sessions will be held all day on Wednesday, January 27.

A low priced ...vacuum type filter

Designed for use as an individual filter for multiple tanks in large shops. Ideal as a quality, low cost filter for small plating shops.

Capacity 500 G.P.H.
Price $395.00
Model PV-20-1000 G.P.H.
Price $850.00

A new simplified construction principle makes this low price possible.

The Sparkler Plater's-Pal will handle acid and cyanide solutions (except chromic acid and high chloride nickel).

The Sparkler PLATER'S-PAL will filter

Arsenic Cyanide
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Zinc Cyanide
Acid Copper Sulphate
Acid Zinc
Black Nickel Acid
Cadmium Fluoborate
Copper Fluoborate
Lead Sodium Fluoborate
Lead Sulfamate
Nickel
Palladium
Tin Fluoborate
Tin Nickel Alloys

Sparkler plating filters are used in some of the largest plating plants in the world.

SPARKLER PLATER'S-PAL FILTER

★ Only clean solution flows through the pump—no excessive pump wear.

★ Visual inspection of all parts including filter plates possible without dismantling filter.

★ All solution reclaimed.

★ Completely enclosed but with easy access to operating parts.

★ Cover locks and unlocks with one quick opening connection—no cover bolts, no complicated sealing devices.

★ Can be cleaned and back in operation in 10 minutes.

★ Positive uniform quality of filtration at all times.

Sold only through plating suppliers

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Sparkler International Ltd., with plants in Canada, Holland, Italy & Australia.

Filtration engineering and manufacturing exclusively for over 25 years.

INDUSTRY NEWS

MORE ZINC USED FOR 1959 AUTOMOBILES

Taken model by model, most 1959 cars use more zinc than their 1958 counterparts, according to an article in the current issue of *Automotive Industries*, Chilton automotive industrial news magazine. Despite styling changes this year emphasizing simplicity of decor, data from car makers and leading zinc suppliers show that the wide range of parts made as zinc die castings in the past continues in 1959 models.

The publication reports that 440 million lb of zinc went into automobiles and accessories in 1957, followed by 314 million lb of zinc used in 1958. Comparing the 6.2 million passenger cars produced in 1957 against 4.3 million produced in 1958, zinc more than held its own on a per-car consumption basis. This position continues in 1959, and indications are for strong increases in 1960.

Although less chromium-plated zinc (as well as other materials) is being used for purely decorative applications this year because of the 1959 styling trend, more zinc is being used for other applications. Automotive die cast zinc parts, which in many 1959 models are heavier than their '58 counterparts, include instrument cluster panels and many grilles or principal parts of grille assemblies.

The magazine reports the following breakdown for applications of zinc die castings in 1959 cars: a) 18 per cent for such functional parts as carburetors, fuel pumps, filters, oil seals, transmission and brake units; b) 70 per cent for functional-decorative parts, such as door and window handles and cranks, rear view mirror assemblies, headlight and tail light housings, instrument cluster panels; and c) 12 per cent employed for purely decorative applications, emblems, medallions, name plates, and trim.

Leading automotive user of zinc die castings in the 1959 model line-up is the Lincoln sedan with a total of 91.92 lb, including such parts as the carburetor (11.06 lb), horn components (3.8 lb), and window frames (8.05 lb). The four-door Cadillac sedan is second with over 90.27 lb of zinc die castings used for such parts as the air intake grille (7.7 lb), the carburetor (6.0 lb), plus an assortment of window frames, horn rings, mirror assemblies, etc.

Low cost and ease of finishing have always been important factors in the popularity of zinc die castings with the automobile industry. Recently improved plating methods further enhance zinc's advantages for automotive applications.

Battelle Memorial Institute tests (sponsored by the American Zinc Institute) are being conducted on the corrosion performance of electroplated coatings applied to zinc die castings by two new approaches already in substantial use in the automobile industry and growing rapidly.

One of the systems uses a modified bright and crack-free chromium coat as thin as 0.000025 in. deposited over conventional layers of copper and nickel. The second plating advance uses a duplex nickel system with two layers of nickel electrodeposited in different baths under controlled conditions employed in conjunction with conventional copper undercoat and chrome finishing layer. Both of these new methods are said to increase corrosion protection value appreciably.

PLATING SCHOOL IN BRITISH COLUMBIA

The AES British Columbia Branch will again conduct a course in electroplating which will run from October 1959 to March 1960. The course will be held at the Vancouver Technical School on East Broadway in Vancouver. The instructor is Walter M. Kellermann of the Aluminum Co. of Canada Ltd. and the tuition fee will be approximately $15 for the complete course.

AEROSPACE FINISHING SYMPOSIUM ON TREATMENT AND FINISHES

A national aerospace finishing symposium on "Treatments and Finishes for Aerospace Materials" will be held in the Dallas-Fort Worth area December 8 and 9, 1959.

The two-day symposium, slated for the Hotel Texas in Fort Worth, will be co-sponsored by the Dallas-Fort Worth Branch of the American Electroplaters' Society and the Southwest Society of Aircraft Materials and Process Engineers.

D. C. "Nic" Novelli of Convair in Fort Worth and member of SAMPE, will serve as conference chairman.

More details on the papers to be presented on the program and the committee chairmen will be announced within the near future.

VITRO PRODUCING NICKEL CHEMICALS

Vitro Rare Metals Co., Canonsburg, Pa., a division of Vitro Corp. of America, has commenced production of nickel sulfate, nickel chloride and nickel carbonate for electroplating operations.

The Canonsburg plant also is producing nickel acetate and formate. These products are distributed by Berkshire Chemicals, Inc., a Vitro subsidiary and exclusive sales agent for all Vitro chemical products.

ALLIED RESEARCH EXPANDS DETROIT PLANT

Allied Research Products, Inc. has expanded its Detroit manufacturing facility by acquiring the 20,000 sq ft building adjacent to its property at 400 Midland Avenue.

The new plant will be known as Plant No. 2 and will also contain increased office space. This move consolidates the equipment manufacturing facilities formerly carried out at Allied's Dix Avenue plant and chemical manufacturing facilities at the Lyndon Avenue plant, both in Detroit. In addition, all of the chemical manufacturing operations that are now carried on at Allied's Baltimore location will be duplicated at the new Detroit facility. Bruno Leonelli is works manager for the Detroit plant.

For the best in reverse-current cleaning

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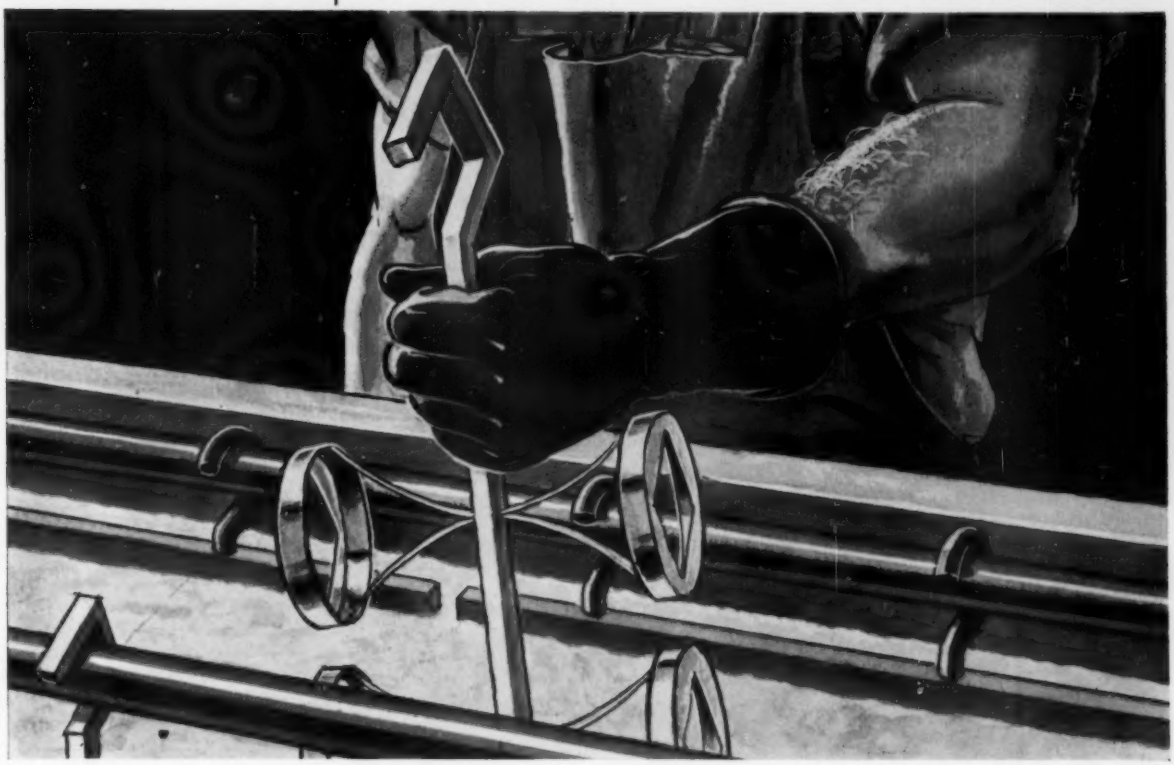
OVER 50 YEARS CLEANING EXPERIENCE • OVER 250 FIELD SERVICE MEN • OVER 160 MATERIALS



3 good reasons why Oakite 90 electrocleaner minimizes plating rejects:

High conductivity, superior smut removal and water-softening ability—there's a trio of good reasons why parts come out of Oakite 90 reverse current baths really ready for electroplating, with no soil nor film to cause subsequent rejection.

(1) High conductivity, of course, puts most of the current to work actually cleaning, instead of dissipating power in overcoming resistance. (2) The superior smut removal stems from Oakite 90's excellent wetting, emulsifying and suspending action that *not only* pries soil off but also prevents redeposition. (3) The water-softening action prevents hard-water scums from forming and clinging to parts as they're drawn from the tank.

Add to these . . . controlled foaming that traps alkaline spray, and exceptionally long solution life . . . still more reasons why Oakite 90 is the "Number One" choice of platers across the country.

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GARFIELD BUFF ACQUIRES TWO FIRMS

In an expansion move, Garfield Buff Co. of Caldwell, N. J. has purchased Koble Equipment and Tank Co., 119 Dayton Ave., Passaic, N. J. and Diamondaire Buff Co., 1308 Cromwell Ave., Bronx, N. Y.

Koble is a developer of fabrication of polypropylene tanks for use in the plating and chemical industries. Diamondaire manufactures uni-directional buff which is claimed to give uniform finish and does not unravel.

MITCHELL-BATE IN LARGER QUARTERS

The Mitchell-Bate Co. of Waterbury, Connecticut, has moved to larger quarters. The firm is now located at 1040 South Main St. in that city. Partners in the company are Raymond L. Mitchell and Thomas C. Bate.

The new modern facilities will enable the firm to expand production and design of racks for plating, anodizing, degreasing and painting. Larger coating facilities have also been installed to increase the scope of service performed in the application of plastisols coatings.

MAGNUS CHEMICAL TO REPRESENT PERFECTO-PEEN

Magnus Chemical Co., Inc., Garwood, N. J., has been appointed a sales representative by Perfecto-Peen, Division of Aero-Test Equipment Co., Dallas, Texas, to handle the general product line for his firm's new process of glass-jet peening.

Magnus will represent Perfecto-Peen in New England, New York, New Jersey, Pennsylvania, Maryland, Virginia and West Virginia.

SEL-REX LOCATES IN GENEVA WITH EUROPEAN DIVISION

The establishment of a European Division in Geneva, Switzerland, with complete facilities for manufacturing and marketing their precious metals plating processes and equipment, has been announced by the Sel-Rex Corp., Nutley, New Jersey. Managed by newly-named vice president, Rene J. Rochat, the division has the responsibility of coordinating the activities of an extensive distributors' network covering major industrial centers in Asia, as well as Europe.

Swiss-born Rene Rochat comes to Sel-Rex with nearly 15 years' uninterrupted experience in the precious metals electroplating field. A graduate chemical engineer of the University of Geneva, he was formerly manager of one of the largest gold refining and precious metal plating operations in Europe.

R. J. Rochat

B. Zwerner

Bill Zwerner, also an alumnus of the University of Geneva, in electrical engineering, has been named manager of manufacturing for the European operations. Mr. Zwerner has had extensive experience in the design and installation of electroplating facilities. He is reported to have engineered the installation of some of the largest precious metals electroplating operations in Europe.

The establishment of the new division is said to have been necessitated by the rapidly growing demand for Sel-Rex products throughout Europe and Asia. In addition to supplying a focal point for marketing activities, Sel-Rex says their new division is equipped to perform analysis of solutions and electrodeposits, and to do sample plating with the various Sel-Rex precious metals processes.

Sel-Rex reports that in anticipation of the official opening of their new division, patents have already been secured on their various exclusive precious metals plating processes in the countries in which they will be distributed.

ARMALITE PLANT NEARS COMPLETION

The Armalite Company Limited is constructing a new manufacturing plant and office building. It is scheduled for completion about Sept. 15. The new 30,000-foot plant is located in Toronto on Queen Elizabeth Boulevard South.

Armalite supplies chemicals, equipment and processes to the metal finishing industries. Among the products that will be made in the new plant are nickel anodes, buffing and polishing compounds, alkali cleaners, as well as plating tanks, rectifiers, vapor degreasers and plating barrels.

Foremost in this expansion will be the enlarged facilities of the service and development laboratories.

NEW DIAMOND ALKALI PLANT IN OPERATION

Diamond Alkali Co. placed into operation its 20 per cent chlorine-caustic soda plant expansion at Deer Park, Texas, on June 15. The initial operating rate of the new facility will be in excess of 50 per cent of capacity.

The new facility brings the aggregate capacity of the company's entire Deer Park Works to a nominal 750 tons per day of chlorine with a concurrent capacity of about 825 tons of caustic soda and 7,500,000 cu ft of high purity hydrogen. The new facility employs the most modern technology in mercury cells, power rectification, and processing of products and raw materials.

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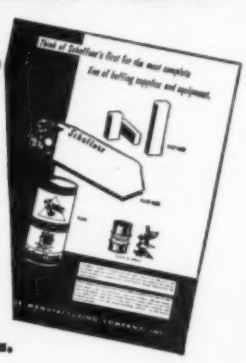
FIRST CHOICE OF PARTICULAR BUFFERS everywhere—SCHAFFNER'S finest and most complete assortment of Buffing Wheels, that produce a smooth, lustrous finish . . . superior compounds made of laboratory-controlled materials. New customers of SCHAFFNER are convinced it's the best move they ever made to increased, trouble-free production . . . for the quality, dependability and efficient service that SCHAFFNER is noted for.

NEW SCHAFFNER BIAS BUFFS PROVE A BIG SUCCESS, a terrific seller! Exclusive, new features give more mileage, longer life! YOUR MARKET IS ENORMOUS—woodworking and metalworking shops, factories, rebuilders, jewelry manufacturers—SCHAFFNER is the answer to all buffing and polishing problems . . . your entree to record sales, and with excellent commissions, heavy repeat orders. Write TODAY for complete details, FREE CATALOG, and preferred territory.



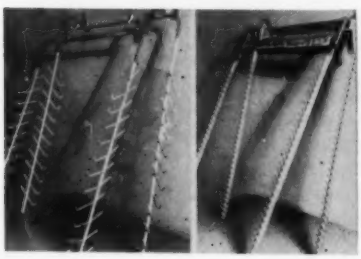
SCHAFFNER MFG. CO. Dept. P-9, 21 Herron Ave., Pittsburgh, Pa.

SILVER BEARING SOLDER CUTS RACK COST

North West Plating Company, Seattle, Washington, makes its own racks for job plating. When racks became weakened by electrolysis as acid found crevasses in the plastic coating, trouble occurred at points where contact tips were bolted to spline or frame.

Leonard Peterson and Joseph Roleau, owners of the plating concern, decided to get rid of the bolts and nuts by brazing contact tips to the spline. However, this created another problem—the heat of brazing annealed the copper contacts with the result that they bent under load.

Next they tried soldering, using a conventional hard solder with minimum temperature requirement for application of 1130F. This heat also had an annealing effect on the copper, causing contact tips to bend when loaded.



At this point it was decided to first establish the temperature limits. It became evident the solder for the job must not melt at 365F, the heat at which the polyvinyl chloride plastic coating is baked onto the rack. On the other hand, the melting point could not be so high that soldering would cause the copper to anneal.

A high-strength, silver-bearing stainless solder* and non-acid flux with a working temperature of 430F, was found to be satisfactory. Tensile strength is approximately 28,000 psi.

North West Plating figures it saved $300 in making a dozen plating racks of the type shown in the illustrations. Soldering eliminated drilling holes in the frame and the use of bolts, washers and nuts. It cut fabrication time by 80 per cent, reduced weight of the finished product, and produced a longer lasting plating rack.

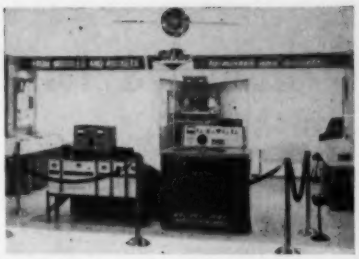
*Solder No. 430, manufactured by All-State Welding Alloys Co., White Plains, N. Y.

MACARR MOVES TO NEW PLANT

Stanley Chait and Philip Bruno principals of Macarr, Inc., have announced the acquisition of new plant facilities.

All manufacturing and servicing are now moved to 4360 Bullard Avenue, Bronx 66, New York.

The increased space and improved facilities were found to be necessary to keep pace with the need to provide advanced design equipment and faster deliveries.



The Sel-Rex Corp. exhibit at the recent AES Fifth Industrial Finishing Exposition focused attention on the wide use of precious metals plating processes and equipment throughout all industry. The display included a Sel-Rex Jet plater in which souvenir clip-on bookmarkers were gold plated for visitors. The focal point of the display—a scale model of the Vanguard earth satellite plated with Sel-Rex bright gold as was the original—was visible from most points in the huge Detroit Armory.

MEDERICK J. BRASSARD

Mederick J. Brassard, 57, of 17 Chester Street, Norwalk, Connecticut, died on August 3 after a long illness.

Mr. Brassard was a member and past president of the AES Bridgeport Branch. He had been with Electrolux Corporation in Old Greenwich, Conn.

He is survived by his widow, Mrs. Julia Fionte Brassard; a son, Lloyd; a daughter, Mrs. Frank (Doris) Nainby; two stepdaughters, three brothers and eight grandchildren.

TECHNICAL PROCEEDINGS AWAITING YOUR ORDER

CONTAINING each of the technical papers delivered before the AES's 45th Annual Convention held in Cincinnati, Ohio, May 19-22, 1958, together with their charts, diagrams, graphs, tables and other illustrations, and with the verbatim discussion that followed their delivery, TECHNICAL PROCEEDINGS (1958 Edition) broadly enriches technical and scientific knowledge in the field of electroplating, metal finishing and allied arts.

It also includes the stenotype report of the panel session on "Practical Plating Problems" that was a hit of that Convention.

A larger book than the 1957 edition, it also carries a front section that includes a complete chronological list of AES Conventions and Past Presidents; a day-to-day log of the 45th Annual Convention; a section on the AES Scientific Achievement Award and on the Paper Awards presented at that convention; a full listing of AES's 1958-1959 Boards and Standing and Special Committees and a complete Branch Directory up to date as at September 1, 1958.

The domestic price of the 1958 Edition of TECHNICAL PROCEEDINGS is $12 per copy including postage. To those ordering from outside of the United States' continental limits, the charge is $15 per copy including postage. All orders must be accompanied by payment in full. Address orders and make checks payable to:

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A limited quantity also exists of the 1956 book at $12.50 per copy domestic; $15 per copy foreign and of the 1957 book at $10 per copy domestic and $12.50 per copy foreign. All orders must be accompanied by payment in full.

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INDUSTRY NEWS BRIEFS

ADVANCES TO BE SHOWN AT CHEMICAL EXPOSITION

New development in continuous process analysis and control will be one of the features of the 27th Exposition of Chemical Industries, to be held at the New York Coliseum, November 30 to December 4.

Many of the analytical process instruments to be shown among the 475 displays in the Coliseum embody the latest technical advances.

A type of process monitor to be exhibited is a completely automatic analyzer which will indicate the carbon content of a sample within minutes. A second fully automatic instrument indicates sulfur content in only three to seven minutes.

An "autoanalyzer" system, as its name implies provides accurate and highly reproducible chemical analyses at rates up to 60 tests an hour; or it can monitor concentrations of such materials as cyanides, silica, phosphates, sugars, aluminum, iron, copper and others.

In the multiple display of single-purpose instruments a liquid level indicator will be shown that employs the reflection of light within a glass prism to actuate relays at high and low level points by means of a photocell.

Research instruments will be seen in considerable numbers, several of extreme accuracy.

TRINZ PRESIDENT OF VULCANIUM CORPORATION

James K. Trinz, recently appointed president of Vulcanium Corporation, has announced the establishment of the company's new plant at 3080 Skokie Valley Highway in Highland Park, Ill.

It is reported that Vulcanium will begin marketing of several new types of adjustable racks.

Mr. Trinz is well known in anodizing and electropolishing circles and specializes in the engineering and development of high capacity standard and custom racking systems.

MAGNESIUM ASSOCIATION ANNUAL CONVENTION

The Hotel Roosevelt will be headquarters for The Magnesium Association's 15th Annual Convention on October 19 and 20.

The Annual Convention of The Magnesium Association is open without fee. Meeting attendance annually includes many designers and engineers from automotive, aircraft and missile, materials handling and the electronics industries, as well as independent fabricators. Details of the program are available from The Magnesium Association offices, 122 E. 42nd St., New York 17, N. Y.

An exhibit of component parts and of finished products of magnesium consumer goods and defense components will be a feature of the meeting.

REYNOLDS PLASTIC LEASES PLANT

Reynolds Plastic Co., Inc. of Indianapolis, Ind. have leased a building in Tipton, Indiana for a plant to manufacture reinforced plastic products. M. Les Reynolds is president of the firm. The decision to start production was made after two years of testing in various industrial fields.

PATENT ABSTRACTS

DR. D. GARDNER FOULKE
SEL-REX CORPORATION
Nutley, New Jersey

Copies of patents may be obtained by writing to Commissioner of Patents, Washington, D. C. Price 25 cents each.

No. 2,872,388, 2/3/59—Electrophoretic Method—F. Fanoe and J. Shyne, assignors to USA (AEC).

A method of forming a fuel element by electrophoretically depositing a fissionable material out of a liquid medium on the surface of a cladding member, thereafter electrolytically depositing a bonding metal through pores of used coating.

10 claims.

No. 2,872,389, 2/3/59—Plating Uranium Surfaces—C. Slunder, assignor to USA (AEC).

Anodize the uranium surface in 50 per cent by weight phosphoric acid containing 20 ml/l of concentrated hydrochloric acid at 35–45C for 10 min at 0.5 asi.

9 claims.

No. 2,872,391, 2/3/59—Printed Wiring Boards—J. Hauser

Claim 1 reads: "The process of forming electrically conductive metal portions extending over surfaces and through holes in an insulation backing comprising the steps of applying a plating resist over the metal surfaces of a sheet of foil clad insulation so as to cover all the surfaces except those forming a conductive pathway pattern, covering the plating resist and the exposed metal surfaces with a strippable film, forming holes through said foil clad insulation and said film in such a way that the ends of the holes are surrounded by foil which is not covered by said plating resist, applying a conductive coating not subject to migration to the walls of said holes, removing said strippable film, plating a first metal over said conductive coating and the surfaces of said foil not covered by said resist, said metal having the properties of high electrical and thermal conductivity and resistance to stress, plating a solder type metal over said first metal, removing said plating resist, and removing by chemical action attacking said foil but not said solder type metal all parts of said foil that had been covered by said plating resist."

4 claims, 5 figures.

No. 2,872,392, 2/3/59—Bright Nickel—B. Martin, assignor to the McGean Chemical Co., Cleveland Heights, Ohio.

A bright nickel bath is described as containing a sulfo-oxygen compound (0.5 to 25 g/l), a secondary brightening agent such as fuchsin (2 to 100 mg/l), and a "quick-brightening" addition agent consisting of lignin sulfonic acid and its salts (0.01 to 1.0 g/l).

15 claims.

No. 2,872,395, 2/3/59—Electrowinning Chromium—M. Carosella, *et al*, assignor to Union Carbide Corp., N. Y.

Lead contained in the chromium sulfate electrolyte is removed by adding barium to co-deposit the lead as lead sulfate.

2 claims.

No. 2,873,214, 2/10/59—Chemically Plating Metals—G. Schnable, assignor to Philco Corporation, Philadelphia, Pa.

A method is described for plating zinc cadmium and manganese articles with more noble metals by immersing in a molten salt solution of the nobler metal.

See also No. 2,873,216 describing a similar method for depositing a Cd-In alloy on aluminum in 15 claims.

See also No. 2,873,233 with 9 claims.

7 claims.

No. 2,873,215, 2/10/59—Coated Iron—F. Quigley and H. Walters, assignors to Dow Chemical Co., Midland, Michigan.

Claim 1 reads: "A method for providing iron with an adherent coating which comprises coating a surface of metallic iron with a thin layer of an aqueous colloidal dispersion comprising a polymer of an aliphatic conjugated diolefin, which aqueous dispersion is characterized by a degree of acidity corresponding to a *p*H value not greater than 5, and drying that layer."

14 claims.

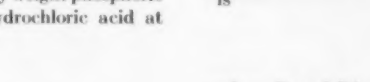
No. 2,873,232—2/10/59—Jet Plating—E. Zimmerman, assignor to Philco Corporation, Philadelphia, Pa.

A jet method for plating indium or gallium on another metal is described.

14 claims, figure.

No. 2,873,234, 2/10/59—Copper Electrodeposition—F. Passel, assignor to Metal and Thermit Corporation, Rahway, N. J.

The use of a selenium bisdithiocarbamate as a brightener for copper cyanide solutions is described. The compound structure is



where R and R′ may be H or an alkyl with up to six carbons. More than 0.001 g/l is required.

See also No. 2,873,235 describing a similar tellurium compound with 9 claims.

9 claims.

No. 2,874,063, 2/17/59—Chemical Nickel Plating—D. Metheny and E. Browar, assignors to General American Transportation Corp., Chicago, Ill.

A method of chemical reduction for nickel is described wherein lead ions are maintained in the bath at a concentration of 1 to 5 ppm.

21 claims, figure.

No. 2,874,072, 2/17/59—Autocatalytic Copper Plating—A. Cahill and Vince McConnell, assignors to General Electric Co., Syracuse, N. Y.

The use of an aqueous solution containing a complex copper ion, hydroxide, formaldehyde and a complexing agent to provide copper deposit on catalytic surfaces immersed therein is described.

48 claims.

No. 2,874,080, 2/17/59—Surface Coatings—O. Schweitzer and E. Bäder, assignors to Degussa, Roessler, Frankfort, Germany.

Claim 1 reads: "A method of adhering a self-hardening polymerizable coating composition to a metallic surface selected from the group consisting of copper, zinc, copper alloys and zinc alloys which comprises applying to said surface a self-hardening polymerizable coating composition containing at least one liquid polymerizable organic compound containing a terminal $CH_2 = C<$ group and a relatively small but effective amount of at least one compound capable of forming a complex with copper and zinc selected from the group consisting of hydroxy quinoline, acetyl acetone and benzoyl acetone to improve the bond of the coating composition to said metallic surface."

21 claims.

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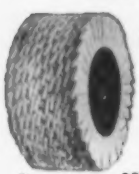

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No. 2,874,081, 2/17/59—Phosphating Pretreatment—W. Cavanagh and J. Maurer, assignors to Parker Rust Proof Co., Detroit, Mich.

A composition for activating metal surfaces in preparation for phosphating is described as containing a titanium compound and a phosphate compound. Low temperature dispersion in water at a *p*H of 5.7 to 7.8 is claimed necessary, after which the composition is dried.

14 claims.

No. 2,874,104, 2/19/59—Electropolishing Method—E. Bowerman and E. Saubestre, assignors to Sylvania Electric Products, Mass.

A method for electropolishing molybdenum and nickel is described. The bath consists of hydrochloric and acetic acids according to diagrams shown in the patent.

5 claims, 5 figures.

No. 2,874,820, 2/24/59—Transfer Apparatus—E. Robert, assignor to the Udylite Corp., Detroit, Michigan.

A unit for transferring racks of work from the conveyor to treating tank and back to conveyor described.

4 claims, 6 figures.

No. 2,875,096, 2/24/59—Hot Dip Galvanizing—W. Diehl and H. Bell, assignors to Wheeling Steel Corp., Wheeling, W. Va.

Strip being hot dip galvanized is drawn upward through the molten spelter and just before the exit rolls two other rolls contact the strip to break the capillary attraction between spelter and strip, thereby preventing excessive carry-out of spelter.

2 claims, figure.

No. 2,875,111, 2/24/59—Phosphate Coatings on Drawn Wire—C. Wilkinson, *et al.* assignors to Parker Rust Proof Co., Detroit, Mich.

Claim 1 reads: "A method of forming a phosphate coating on wire which comprises the steps of passing the wire in a chemically clean condition, continuously in an axial direction through an aqueous acidic accelerated phosphate coating solution selected from the group consisting of zinc, manganese, iron and cadmium phosphate solutions and having a pointage greater than about 40 and containing an accelerator selected from the group consisting of nitrite, nitrophenol, nitroguanidine, a mixture of chlorate and nitrate and a mixture of nitrite and nitrate, the ratio to phosphate of said accelerator being in the range of 0.0075 to 0.6, reulgating the speed of travel and the duration of immersion of the wire in the solution with the degree of acceleration so that the initial formation of the coating occurs in the coating solution and the wire emerges from the coating solution carrying a uniform film of the solution on its surface, which film serves to complete the formation of the phosphate coating on the surface of the wire."

8 claims.

No. 2,875,112, 2/24/59—Improving Physical Properties of Chromized Articles—C. Wilkinson, *et al*, assignors to Parker Rust Proof Co., Detroit, Mich.

The physical properties of a chromized article may be improved by quenching from a temperature of 900 and 950C.

3 claims.

No. 2,875,514, 3/3/59—Aluminum Solder—R. Doerr, assignor to Olin Mathieson Chemical Corp., Va.

A flux is described for soldering aluminum as essentially composed of a reaction product of a lower alkyl ketone, stannous chloride, a zinc halide and a hydrazine hydrohalide. See also No. 2,876,138 titled metal coating of light metals (16 claims).

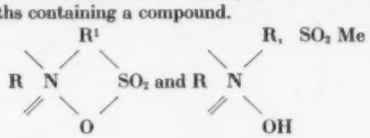
14 claims.

No. 2,876,137, 3/3/59—Method of Plating Metal With Magnesium—F. Drummond, assignor to The Commonwealth

Engineering Co., Dayton, Ohio.
A gas plating method is described.
2 claims.

No. 2,876,144, 3/3/59—Pickling Solutions—H. Bomberg and M. Vordahl, assignors to Crucible Steel Corp., Flemington, N.J.
For pickling titanium and vanadium without hydrogen embrittlement use 0.5-10 per cent phosphoric acid, 0.5 to 10 per cent of fluoride ions and 15-50 per cent HNO_3, 5 to 35 per cent H_2O_2 or a combination of the two.
9 Claims.

No. 2,876,177, 3/3/59—Nickel Plating—Gündel, *et al*, assignors to Dehyday, Dusseldorf, Germany.
Bright, smooth, ductile nickel deposits are obtained from Watts' baths containing a compound.



where

R N being a heterocyclic radical

R_1 being aliphatic, cycloaliphatic and aromatic radicals

Me is a metal ion

10 claims.

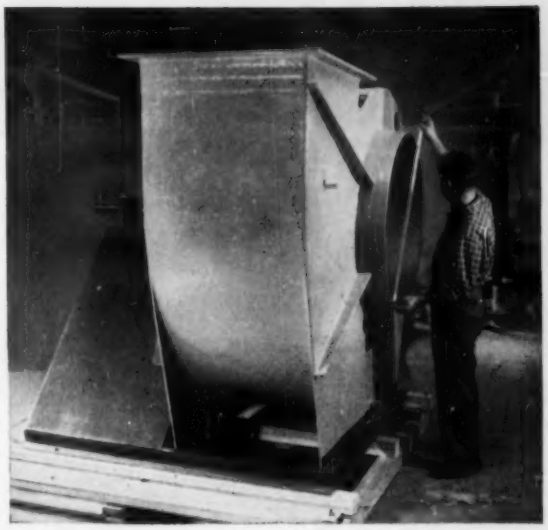
No. 2,876,178, 3/3/59—Electrodepositing Copper—E. McCoy, Milwaukee, Wis.
A process for plating copper is claimed wherein at least 0.001 g/l of cobalt or nickel and at least 0.05 g/l of 2,4-lutidene and 2,6-lutidene are added to a cyanide copper bath.
3 claims.

No. 2,877,145, 3/10/59—Coating—C. Baer and P. Clough, assignors to National Research Corp., Cambridge, Mass.
The process is described as coating a substrate with zinc by vacuum techniques, the improvement consists of maintaining a supply of molten zinc at above 700C.
6 claims.

No. 2,877,148, 3/10/59—Phosphate Coating—R. Drysdale and S. Burton, assignors to the Walterisation Co., Ltd., Croydon, England.
Claim 1 reads: "A method of treating a metal surface which comprises applying to the surface, by the impingement contact of a spray thereon, an initial film of a liquid composition which reacts therewith to produce a change in the nature of the surface, maintaining the thus sprayed surface out of impingement contact with the spray, and in a substantially undisturbed state, for a period sufficient to permit reaction of the film with the surface, repeating this sequence of operations at least once to maintain on the surface a reactive film of the same nature as that of said initial film during each interval between successive spray applications, and controlling the duration of each spray application so that the total period of time between the first and last spray applications during which the surface is out of impingement contact with the spray is several times the total period of time during which the surface is in impingement contact with the spray."
6 claims, 4 figures.

No. 2,877,165, 3/10/59—Electrolytic Refining of Lead—G. Turner, assignor to The Consolidated Mining and Smelting Co. of Canada, Montreal, Canada.
The addition of the hot water extract of red cedar to lead fluosilicate electrolytes is described.
4 claims.

(Continued on page 1101)



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Most of the articles listed here may be obtained by writing to the publications in which the articles were published. Addresses are given at the end of the references for the reader's convenience.

Photostat or microfilm copies of articles in available magazines may be obtained from: Library of Congress, Washington, D. C.; New York Public Library, New York; Engineering Societies' Library, New York, at prevailing rates. In other cases, consult Wilson's Union List of Serials at your nearest public library for other sources of these articles.

97. ALUMINUM

a. *ANODIC BEHAVIOR OF ALUMINUM AT LOW POTENTIALS.*
J. V. Petrocelli.
Journal of the Electrochemical Society, *106*, No. 7, July 1959, pp. 566–570.

98. CHROMIUM

a. *DUPLEX CHROMIUM: THICKER, MORE CORROSION-RESISTANT CHROMIUM PLATE.*
Edgar J. Seyb Jr.
Products Finishing, July 1959, pp. 64-78.

99. CONTROL

a. *CONTROL OF ELECTRODEPOSITION PROCESSES BY EXAMINATION OF THE DEPOSITS.*
T. E. Such.
Electroplating and Metal Finishing, *12*, No. 7, July 1959, pp. 256–259.

100. COPPER

a. *SCIENCE FOR ELECTROPLATERS. 49. COPPER PLATING.*
L. Serota.
Metal Finishing, *57*, No. 7, July 1959, pp. 72–74, 81.

101. CORROSION

a. *POTENTIAL STUDIES ON PASSIVITY TO CORROSION INDUCED BY PRETREATMENT PROCESSES. II. COMPARATIVE STUDY OF CHROMATE TREATMENT AND CHROMATE INHIBITION.*
K. S. Rajogopalan and K. Balakrishnan.
Journal of the Electrochemical Society, *106*, No. 7, July 1959, pp. 562–566.

102. ELECTROFORMING

a. *ELECTROFORMING WAVEGUIDES.*
J. R. Balmer and T. W. A. Bailey.
Electroplating and Metal Finishing, *12*, No. 7, July 1959, pp. 267–270.

103. FINISHING

a. *SURFACE FINISHING STAINLESS STEELS.*
Lester F. Spencer.
Metal Finishing, *57*, No. 7, July 1959, pp. 48–53, 58.

b. *BETTER BUFFING THRU BETTER BUFF DESIGN.*
Stanley P. Sax.
Metal Finishing, *57*, No. 7, July 1959, pp. 54–58.

104. MISCELLANEOUS

a. *INSTITUTE OF METAL FINISHING ANNUAL CONFERENCE—BRIGHTON 1959.*
R. Pinner.
Metal Finishing, *57*, No. 7, July 1959, pp. 59–64.

b. *THE ANODIC OXIDATION OF ZINC AND A METHOD OF ALTERING THE CHARACTERISTICS OF THE ANODIC FILMS.*
H. Fry and Marjorie Whitaker.
Journal of the Electrochemical Society, *106*, No. 7, July 1959, pp. 606-611.

c. *EXTERIOR AUTOMOTIVE TRIM: CHROMIUM PLATE, STAINLESS OR ALUMINUM?*
Myron B. Diggin, R. V. VandenBerg, V. J. Snodgrass.
Products Finishing, July 1959, pp. 30–31, 44, 46, 50–58.

105. NICKEL

a. *EFFECTS OF CHLORIDE ON THE ORIENTATION OF NICKEL DEPOSITS.*
B. C. Banerjee and A. Goswami.
Journal of the Electrochemical Society, *106*, No. 7, July 1959, pp. 590–592.

106. ORGANIC

a. *ORGANIC PROTECTION SCHEMES FOR MODERN HELICOPTERS.*
P. W. Hyde.
Electroplating and Metal Finishing, *12*, No. 7, July 1959, pp. 249–254.

b. *HYDROSTATIC SPRAYING OF ORGANIC FINISHES.*
J. Arthur Weed.
Metal Finishing, *57*, No. 7, July 1959, pp. 70–71.

107. PREPARATION

a. *FINISHING POINTERS: PLATING ON INCONEL.*
Ed Calderon.
Metal Finishing, *57*, No. 7, July 1959, pp. 64 & 69.

108. ZIRCONIUM

a. *DEVELOPMENTS IN FINISHING ZIRCONIUM.*
Nelson F. Murphy
Products Finishing, June 1959, pp. 166–170.

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Teddington, Middlesex
England

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1860 Broadway
New York 23, N. Y.

Metal Finishing
381 Broadway
Westwood, N. J.

Products Finishing
431 Main St.
Cincinnati, Ohio

ACKNOWLEDGEMENT

In the article "Tin in Electroplating" (Plating, June 1959) reference to the original research on the galvanic corrosion of tin plated metals was unfortunately omitted. Credit should be given to Martin S. Frant, AMP Inc. for his paper *Galvanic Corrosion of Simulated Electrical Connectors in Dilute Salt Spray*, presented at the Third EIA Conference on Reliable Electrical Connections in Dallas, December 1958.

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	A	B	C	D	E	F	G
TO PLUG HOLE SIZE	1/8-3/16	3/16-1/4	1/4-5/16	5/16-1/2	1/2-5/8	9/16-11/16	5/8-3/4
TO CAP STUD SIZE	3/32-5/32	5/32-3/16	3/16-1/4	1/4-5/16	5/16-3/8	3/8-7/16	5/16-1/2

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Technological knowledge acquired through many years of experience, plus special processes and equipment, assure the high quality of our Rhodium Plating Solutions.

Recommended for contact surfaces of switches, waveguide parts and other electrical applications, such as printed circuits...Can be applied in extremely heavy deposits, up to 100 milligrams per square inch.

Rhodium plating provides the advantages of whiteness, lustre and corrosion resistance of a precious metal.

SIGMUND COHN MFG. CO., INC.

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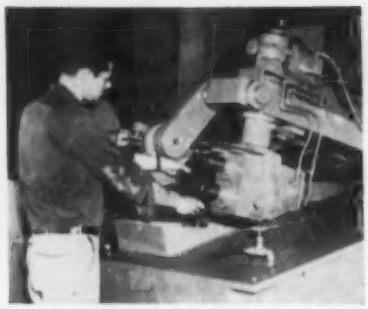
EQUIPMENT AND SUPPLIES



E—901. Finishing Machine—The Mecha-Finish Corp. announce a new unit, the MM-1-2-High Speed Dual Spindle Unit, which has been designed for a multiplicity of parts. It is said to have the specific advantage of handling low production of many different parts and/or high production of a single part.

The parts are mounted on spindle fixtures, air operated, which are submerged, while rotating, in a fluid abrasive mass which simulates a form fitting grinding wheel. The machine at a 15-second time cycle, will produce 240 pieces per hour per spindle and has capacity up to an 8¼ in. diameter part.

E—902. Automatic Spray Gun—To bring the nozzle closer to the work, where space is too limited for mounting the complete nozzle assembly, Spraying Systems Co. has introduced a new Auto Jet spray gun with extensions for hydraulic spray coating. A wide choice of interchangeable orifice tips permits selection of desired capacities and spray patterns. Extensions are supplied standard in 8, 18 and 24 in. lengths and special lengths are available as specified.

The valve stem extends through the extension and the valve seat is positioned immediately behind the orifice tip to provide drip-free, instantaneous shut-off. Liquids are sprayed by hydraulic pressure at recommended pressures up to 125 psi. The shut-off valve mechanism is air operated at 70 to 100 lbs. pressure and provides automatic on-and-off spray nozzle operation at any required cycling frequency.

E—903. Vibrator—Model 1930E, a 15-hp Lorco Vibrator for precision finishing, operates from 10 to 100 times faster than tumbling barrels of comparable capacity according to Lord Chemical Corp. It will clean, descale, debur, radius, fine finish, color, burnish or ball burnish metal, wooden or plastic parts.

Media, compound and water are required as with conventional tumbling if a wet process is used. The load of parts and media rotates as a mass, and an additional scrubbing action between the load constituents is induced through the controlled vibration. Both the amplitude and the frequency of vibration can be controlled, allowing the vibrator to do everything from coarse work, requiring severe cut-down, to the most delicate precision jobs. Interior finishes and finishes in shielded areas can be obtained.

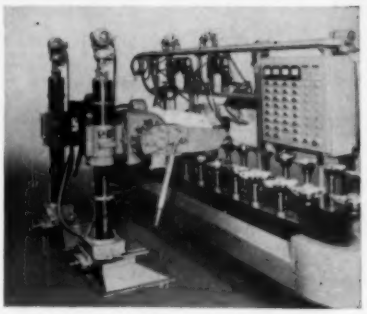
The rubber-lined bowl is mounted on coil and leaf springs. Bowl is vibrated by an eccentric shaft. Drive speed is continuously variable over a range of from 0 to 2100 rpm.
Lord Chemical Corp., 2068 South Queen St., York, Pa.

E—904. Barrel Finishing Chip—A new barrel finishing media designed for zinc die castings which is claimed to offer fast cutdown, produce a low micro-inch surface and protect workpieces against surface impingement has been announced by Minnesota Mining and Manufacturing Co.

Called Honite brand Z-N tumbling shape, the new media offers characterisitics not previously available in any media for barrel finishing zinc die castings, the 3M company points out.

The media's rapid cutting rate reduces barrel time. Present media shape is that of a truncated pyramid.

Many zinc die castings previously not mass processed because of a lack of suitable media to generate an acceptable pre-plate finish can now be barrel finished and take a plate comparable to a hand-buffed piece, 3M said.



E—905. Automatic Polishing Machine—A new Acme line-type universal straight-line automatic polishing machine that provides maximum compactness and operation flexibility for high production parts is available from Acme Manufacturing Co.

Basically the machine consists of an in-line conveyor that moves one-foot long cast iron platens around the periphery of the unit. A special motorized chain drives the platens at feed rates from 4 to 29-ft per minute. The platens are supported at top, bottom and sides by rollers. Work spindle assemblies are attached to each platen with dovetail mountings. Sprockets on the end of each spindle assembly can be driven in either direction by separate fixed or motorized roller chain arrangements at any position along the conveyor to provide efficient polishing speeds.

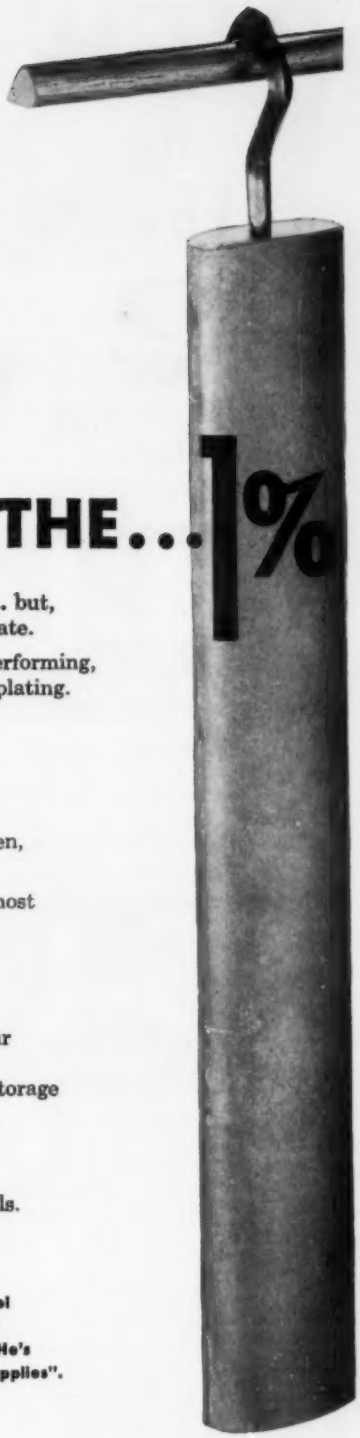
Polishing or buffing operations are performed by separate adjustable lathes placed around the periphery of the conveyor unit. Each lathe can be provided with rotating buffs, polishing wheels or abrasive belt heads to perform the desired polishing or buffing sequence.

E—906. Electroless Gold Process—A new gold chemical deposit process, developed by Everlube Metal Finishing Division, permits deposit of gold evenly on all surfaces, it is reported.

While standard immersion processes for gold plating have been limited to a few molecules thickness, this new gold is claimed to achieve build-up thickness as desired by the engineer.

The process requires no electrical current nor is it an ion exchange reaction, and therefore gives the advantages of even build-up on the most complex parts to thicknesses previously only possible by electrical charge, according to the manufacturer.

LOOK FOR THE DIAMONDS—SIGN OF FINISHING QUALITY



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LIQUID TRIPOLI

An excellent all purpose grade which does an outstanding buffing job on die castings, brass and aluminum. Exceptionally fast cutting. Easily cleaned.

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Emulsion type with exceptionally fast cutting properties. Excellent for cut down buffing of steel or stainless steel parts. Medium heavy viscosity. Readily cleaned.

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STEVENS
INCORPORATED
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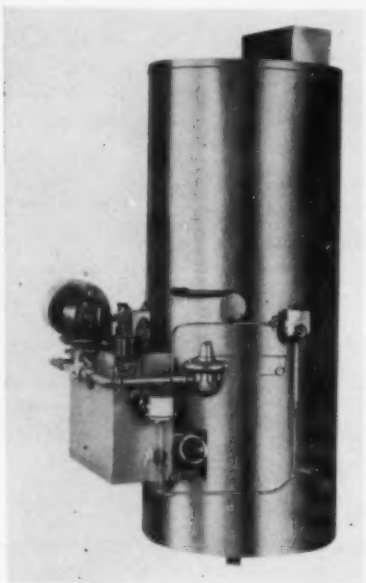
E—907. Corrosion Measuring Unit—Automatic corrosion measurements are now possible, using a new servo-controlled Corrosometer, states the manufacturer, Crest Instrument Division, Magna Products, Inc.

The new Model L-2 Corrosometer is claimed to be capable of detecting as little as one millionth of an inch of corrosion on a routine basis and one billionth of an inch in some special applications. It automatically "tracks" corrosion as it occurs, providing a permanent record of the total thickness of metal corroded. This record is presented as a function of time which is quickly converted to the rate of attack.

In the laboratory, the instrument is said to simplify the job of evaluating the effects of corrosion inhibitors on the resistance of various metals to known corrosive conditions.

E—908. Vertical Water Heater—A new line of V-CD immersion water heaters are vertical floor-space saving versions of the Sellers controlled draft water heater. These immersion firing heaters are claimed



to be simple, compact and fully automatic; solid copper firing tubes are featured.

These improved vertical models have been returned to the Sellers Engineering Co. line because of the increased demand for a "package" type large volume heater requiring a minimum of floor space.

Sellers Model V-CD vertical water heater is made in two types; the standard model which is direct fired and provided with solid copper tubes; and the indirect model equipped with a copper tube heat exchanger and steel firing tubes.

Save More IMMEDIATE SHIPMENT!

Select from one of the nation's largest stocks of guaranteed rebuilt electroplating motor generator sets and rectifiers with full control equipment.

PLATERS

1—8000/4000 AMPERE, 6/12 VOLT, **CHANDEYSSON,** Synch.

1—7500/3750 AMPERE, 9/18 VOLT, **H-VW-M,** Synch.

1—7500/3750 AMPERE, 6/12 VOLT, 25°C. **CHANDEYSSON,** Synch.

1—6000/3000 AMPERE, 6/12 VOLT, **ELECTRIC PRODUCTS,** Synch.

1—5000/2500 AMPERE, 12/24 VOLT, **CHANDEYSSON,** Synch.

2—5000/2500 AMP., 9/18 V., 25°C., **CHANDEYSSON,** Synch. Exciter-in-head.

1—5000/2500 AMPERE, 6/12 VOLT, 25°C. **CHANDEYSSON,** Synch.

1—4000/2000 AMPERE, 6/12 VOLT, **H-VW-M,** Synch., Exc.-in-head.

3—3000/1500 AMPERE, 12/24 VOLT, **CHANDEYSSON,** Exciter-in-head.

1—2000/1000 AMPERE, 6/12 VOLT, **H-VW-M.**

1—1500/750 AMPERE, 12/24 VOLT, **CHANDEYSSON,** Synchronous.

ANODIZERS

1—1000 AMPERE, 40 VOLT, **CHANDEYSSON,** 25°C.

1—1000 AMPERE, 30 VOLT, **IDEAL,** Exciter-in-head.

1—500 AMPERE, 25 VOLT, **CHANDEYSSON,** Synchronous, Exciter-in-head.

2—400 AMPERE, 40 VOLT **M.G.C.,** Separately Excited.

RECTIFIERS

1—**G. E.** 2000/1000 AMP., 6/12 V.

1—**SEL-REX** SELENIUM, 1200 AMPS., 9 V. for 440/3/60.

2—1500/750 AMPERE, 6/12 VOLT, **UDYLITE-MALLORY.**

1—**NEW G. E.** 2000/1000 AMPS., 6/12 V. Remote Control 440/3/60 AC.

SPECIAL

1—Model A, Production Pipe Polisher. Vertical, Abrasive Belt Model.

2—**CROWN & H-VW-M** Centrifugal Driers No. 1 and No. 2 with Heat.

2—**MERCIL** Ball Burnishing Barrels, Sizes 1 and 2.

3—**LASALCO** Ball Burnishers, No. 1, 2 & 4, Lined or Unlined.

1—**L'HOMMEDIEU** 5 H.P. Variable Speed Buffer, Model 18.

10—Buffing Lathes—**HAMMOND, DIVINE, U. S.,** etc., from 3 H.P. to 20 H.P.

3—**INDUSTRIAL** RDR-1 Rubber Lined Filters, Sizes 10x28, 18x28, 14x36.

2—**INDUSTRIAL** Type SC Filters for Cyanide. 18x48 and 18x36.

Other outstanding values in stock.
1929—1959 — 30 Years of Service.

M. E. BAKER CO.
Kirkland 7-5460
25 Wheeler St., Cambridge 38, Mass.

E—909. Smut Remover—Hydra-Blast has developed a process for the removal of smut from ferrous and non-ferrous alloys.

The process removes rapidly the smut that usually appears on the surface of metals, after etching, pickling, chemical milling and can penetrate relatively inaccessible cracks, corners, recess, holes, etc. After rinsing, the metallic surface is mechanically and chemically clean, and ready for plating, painting, anodizing or phosphating.

E—910. Dry Powder Strippers—Heatbath Corp. introduces two new dry powdered products known as Stripal No. 4 and No. 5 for use in stripping anodized and oxide coatings from aluminum. Although they are used for the same purpose, they are very different from each other. Stripal No. 5 is an alkaline powder that can be used in a steel container at 2 lb/gal without heat to give a rapid stripping of anodized or oxide coatings from aluminum. Stripal No. 4 is an acid powder used at 1 lb/gal at a temperature of 180–190F for removing anodic coatings leaving the aluminum brite and free from smut. Both Stripal No. 4 and No. 5 contain incorporated inhibitors for preventing attack on the underlying aluminum.

E—911. Roll-Top Zinc Anodes—Allied Research Products, Inc. has announced the introduction of a new type of anode for zinc plating.

Called the Roll-Top anode, it is cast in a modified oval form. This shape is said to provide approximately 20 per cent more surface area than standard ball anodes, yet allows the Roll-Top anode to roll easily into a curved hanger basket or backfeed chute for automatics. Because of the shape, there is no problem of hangup in the containers.

E—912. Ceramic Filter Element—A new porous ceramic filter element, made from specially formulated glass fused under controlled conditions of temperature and pressure, reportedly has exceptionally high resistance to heat, heat shock and chemical attack. Designed primarily for microfiltration of corrosive and high temperature liquids and gases, the porous ceramic element's effectiveness has been tested on such applications as clarifying 95 per cent sulphuric acid solutions, 50 per cent hydrogen peroxide, and removing radioactive contaminants from boiler water in nuclear reactors according to Commercial Filters Corp., its manufacturer.

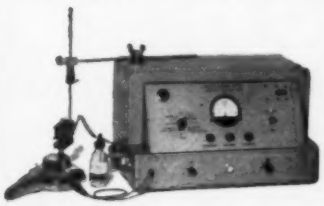
Uniform structure of the ceramic material is claimed to give particle retention up to 98 per cent for each rated density. Filters are currently available in 1, 5, 10, 25, 50 and 100 micron particle retention ratings

E—913. Abrasive Wheels—A completely new form of abrasives—wheels and rolls of non-woven nylon fiber with abrasive grain dispersed throughout—appears to offer considerable promise in finishing and polishing.

The new Bear wheels have been developed by Behr-Manning Co., a division of Norton Company. They are said to be

PLATING THICKNESS TESTING

accurate . . . simple . . . quick with Model 955



- direct reading
- virtually automatic
- 90–95% accurate
- simple operation

Model 955 determines the thickness of heavy or decorative chromium, silver, tin, cadmium, zinc, brass, copper, nickel, lead and other alloy deposits, on various basis metals (including COPPER-NICKEL-CHROMIUM-Composite Coatings). Write for Bulletin 400 and ask for details on a 15 Day FREE Trial!

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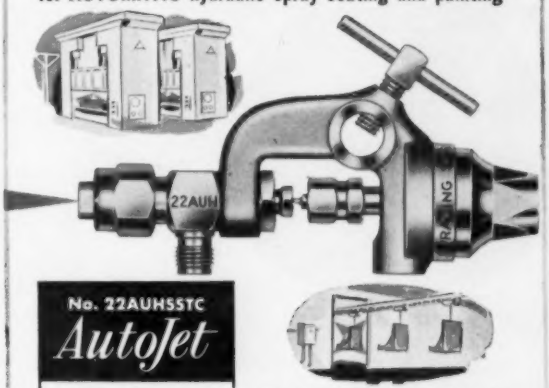
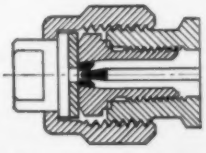
Specify KOCOUR test sets from your supplier.

for AUTOMATIC hydraulic spray coating and painting



No. 22AUH55TC
AutoJet

with
TUNGSTEN CARBIDE valve seat and needle
•
STAINLESS STEEL body and cap
•
TEFLON packings



for dependable, trouble-free performance—operates automatically at any required cycling speed, controlled by air actuated shut-off valve. Paint or coatings atomized by hydraulic pressure alone at pressures from 400 to 2,000 psi. Complete choice of interchangeable orifice tips in all spray patterns, capacities and materials.

SPRAYING SYSTEMS CO.
3227 Randolph Street • Bellwood, Illinois

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best suited for such operations as cleaning, the development of decorative straight-line or swirl patterns, and the imposition of matte finishes where high reflectance is undesirable.

They are not designed for stock removal or even for normal grinding or deburring.

They are made in all normal diameters, in face widths up to 60 in., and in a grit range from 100 to 600. Various abrasives have been employed in early production, though most testing has been done with silicon carbide.

Typical areas where the wheels are recommended include: polishing stainless steel sheet, blending stainless steel welds (after the weld beads have been ground off with a belt), cleaning aluminum panels before anodizing, producing satin finishes on flat sheets of ferrous and non-ferrous metals, and cleaning copper oxides off the foil on printed circuit panels.

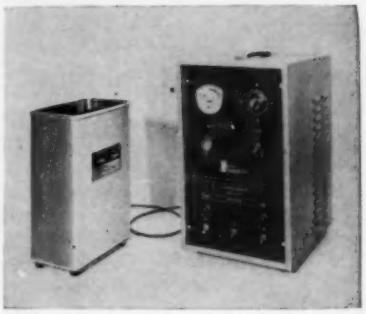
E—914. Polishing and Buffing Heads Position Indicator—Murray-Way Corp. recently announced that their buffing and polishing heads are now available with numbered dials which take the guesswork out of head positioning.

Once correct head positions are found and recorded, heads may be changed and quickly repositioned by use of the dial numbers. Any variation or change in head position appears on the indicator dial.

E—915. Bright Nickel Process—A new, economical, bright nickel plating process, "Hi-Thro," has been announced by Seymour Manufacturing Co. Patents have been applied for.

According to the announcement, the new product not only has high "throwing" power, but produces a cleaner, whiter, and brighter deposit, free from the black deposits normally encountered in low density areas.

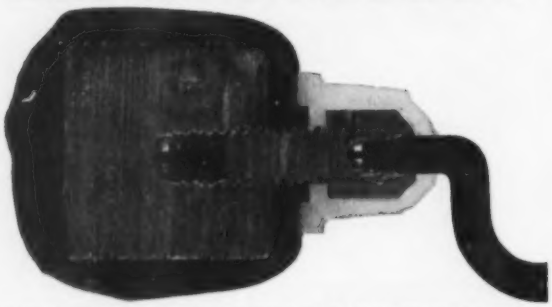
"Hi-Thro" is claimed to be a fast, economical process offering a number of important production advantages, among them a wide *p*H range (2.8 to 4.5), wide current density and temperature range, quick brightness-building qualities, tolerance to impurities, and receptivity to chrome and other plating.



E—916. Ultrasonic Cleaner—An ultrasonic cleaner for applications in which high energy density is required, has been announced by National Ultrasonic Corp. Model 220 in National Ultrasonic's heavy-duty line, the unit features a 2-gallon tank made of heavy-gauge polished stainless steel. Tank is 9 in. long, 6 in. wide and 10 in. deep. Forty-four-and-one-half per cent of the bottom of this tank is covered with driving elements. This is a larger percentage of coverage than that provided in most ultrasonic cleaners.

The generator, 115 volts ac single-phase 60 cycle, is designed for continuous operation. It delivers an average power output of 125 watts and produces peaks of 500 watts.

LEAK-PROOF!



NEW DAVIES REPLACEABLE RACK TIP STUDS

This cross-section photo . . . 3 times life-size . . . shows how the Davies-developed polyethylene stud cap seats tight in the plastisol rack coating.

In two years of tests, not one drop of solution leaked through. If you want more life from studs and spines . . . and less rack rebuilding . . . you want Davies racks with leak-proof studs.

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Whatever you're buffing—from Aluminum to Zinc—Seeley Buffing Compounds buff better, and more economically! Send in your buffing problem to Seeley's Metal Finishing Clinic—and give your products the finest finishes they could possibly have.

Free SAMPLE . . . sent or brought to you by our representative on request. Be sure to specify type of wheel, metal and operation.

- BAR
- LIQUID
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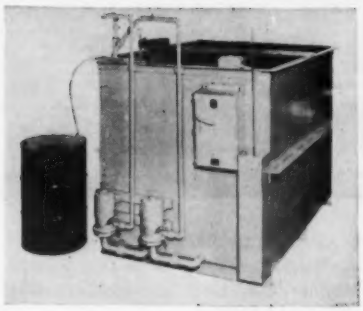
- LIQUID-GREASELESS COMPOUNDS

E. E. SEELEY COMPANY, Inc.
P. O. Box 883 Bridgeport 1, Conn.



E—917. Cyanide Waste Disposal—A new low-cost cyanizer package, Model 6444, for treatment and disposal of cyanide wastes from plating operations with sodium hypochlorite, is now available from the George L. Nankervis Co.

The new cyanizer package contains a sump tank, baffle tank, pumps and controls. Cyanide wastes are collected in the sump and pumped into a specially designed baffle tank for neutralization with a concentrated solution of sodium hypochlorite. Wastes remain in the baffle tank for treatment of one hour. During this time, sodium hypochlorite solution, automatically metering into the tank, completely neutralizes the waste.

Operation of the new Model 6444 cyanizer package is entirely automatic and continuous. No operator is required. Since the discharge of the cyanizer is fully neutralized, it can be dumped into municipal sewer systems with complete safety.

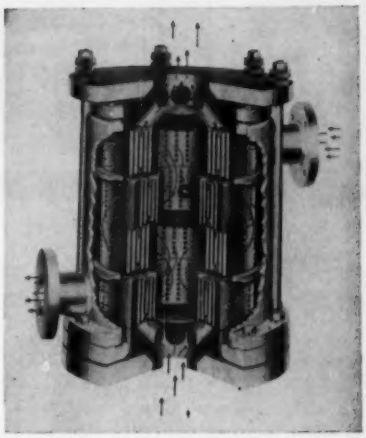
E—918. Vibrating Finishing Barrel—Greater speed and efficiency in barrel finishing, at lower cost, are now claimed possible by Vibraslide 5, vibrating-rotating machine developed by the B. W. Elliott Mfg. Co., Inc.

Vibraslide 5 is a refinement of the company's Vibraslide 20 machine, introduced less than two years ago. The new model, with 5 cu ft capacity and increased vibratory action, resulted from requests for a smaller vibratory unit.

Vibraslide 5 operates at 3 hp. The speed of the vibrator is 2300 cycles per minute, and both ends of the barrel are synchronized with timing belts so that vibration is uniform throughout the media.

E—919. Barrel Finishing Compound—The Esbec Barrel Finishing Corporation has announced a new, dual purpose abrasive compound, known as Esbec 680. It is said to combine fast cutting action with fine surface refinement and cleanliness of surface on most metals, including steel, stainless steel, copper, brass, aluminum.

E—920. Graphite Heat Exchanger—A corrosion resistant graphite heat exchanger, the Polybloc composed of easily



interchangeable, impervious graphite blocks, molded to give high thermal conductivity is a product of The Carbone Corp.

Heat exchange takes place between two sets of passages, axial and radial, and the efficiency of this unit is increased by the continuous turbulence caused by the mixing chambers between the blocks. This, coupled with the absence of cemented joints, provides a corrosion resistant, compact heat exchanger.

This exchanger is for such applications as the cooling and heating of anodizing solutions, plating solutions, pickling acids.

MOISTURE-FREE SURFACES in 1/2 THE TIME!

Model 20 New Holland KREIDER Centrifugal Dryer

Air-dries . . . as it Spin-dries! Eliminates scoring and marring . . . speeds up production . . . cuts down on rejects!

SPECIFICATIONS:
1-h.p. motor—220, 440, 550 volts—2 or 3 phase. Spins 75-lb. loads at 825 r.p.m. Quiet V-belt drive. Arc-welded steel plate construction. Weight 490 lbs. Requires minimum floor space. Meets N.E.C. specs. Auxiliary electric or steam heating units available as optional equipment.

Send for illustrated 4-page folder. Write Dept. P-959

NEW HOLLAND MACHINE COMPANY
NEW HOLLAND, PA.

NEW!
defies chemical attack, heat

Sethco all plastic High Temp. Epoxy Sump Filter Pump
with detachable FILTER CHAMBER

Model UAL-20 200-300 Gals./Hr.
other models from 50-1200 Gals./Hr.

Compact, takes little space in tank.

Get flexible filtration and agitation by: (1) Rotating your sump pump while having a filter chamber of the correct size attached to each plating tank. (2) Rotating your filter chamber using an individual sump pump in each tank. (3) Using one sump filter pump for ALL your tanks. (4) Using a separate sump filter pump for each tank where continuous filtration is necessary.

- Self priming pump
- ½ Hp Motor
- Epoxy body, assembly, impeller
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Sethco MANUFACTURING CORP.

MAyfair 3-4220 • 2290 Babylon Tpke., Merrick, L. I., N. Y.

TRADE LITERATURE

L—901. Automatic Buffing—A new 16-page manual, bulletin LIQ-600, on automatic liquid spray buffing contains data on set-up and operating procedures for automatic buffing, burring and polishing has been made available by The Leu Manufacturing Co. Information includes material on recommended abrasive grades, drawings of typical layouts and a section on recommended equipment.

L—902. Ultrasonic Cleaning—A newly published booklet, entitled, "Tips on Ultrasonic Cleaning," is being offered by Circo Ultrasonic Corp.

The 12-page booklet includes a simplified explanation of the basic principles of ultrasonics, a brief description of the generating equipment and transducers required for ultrasonic cleaning, a discussion of proven applications, and a list of seventeen of the most frequently asked questions about ultrasonics, with appropriate answers.

L—903. Cleaners, Addition Agents, Phosphatizing Compounds—A four-page brochure covering their entire line of products is available from Northwest Chemical Co. Included is information on the proper immersion, electrolytic or spray cleaners to be used on particular metals. Also included are data on acid addition agents, strippers and drawing compounds.

Another booklet from the same company describes their Interlox phosphatizing compounds with details for use as a prepaint treatment for steel and for iron phosphatizing.

L—904. Oxide and Tarnish Remover—An acid base liquid for removing oxide and tarnish from copper, copper alloys and silver is described in Technical Data Sheet No. 77, a two-page usage and instruction sheet prepared by MacDermid Incorporated. Called Metex L-5 it permits processing of work by immersion, brush or swab. Metals processed in it may be electroplated or painted without difficulty. It is also a material for cleaning copper-clad phenolic base printed circuit boards or silver-plated circuits after chromic acid strip.

L—905. Protective Coatings—A series of three case history folders describing applications of protective coating systems has recently been prepared by the M-W Protective Coating Division of Metalweld, Inc.

In addition to the case histories, each folder also gives a picture story of the right lining for specific corrosion problems.

L—906. Chemical and Metallurgical Service—A new brochure detailing their complete testing facilities has just been announced by The Frank L. Crobaugh Co.

Pictured and listed is Crobaugh's equipment for organic and inorganic chemical analysis, metallurgical physical testing, metallography, spectrographic analysis, corrosion testing, radiography inspection of castings and weldments. A special section describes the use of cobalt 60 and iridium 192 for radiography of castings when regular X-ray is no longer feasible.

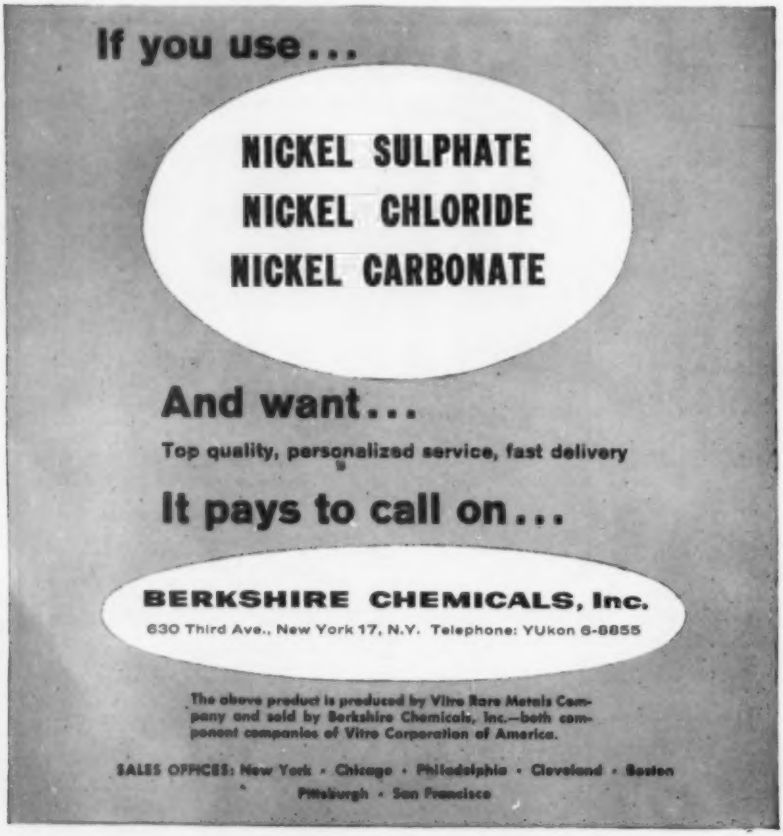
L—907. Regulated Power—Constant current and constant voltage automatic switchover regulated power supplies are described in Bulletin HVVC-95. These supplies are available in a wide variety of control configurations and power outputs into the KVA range. This bulletin is available from Matthew Laboratories.

L—908. Buffs and Polishing Wheels—The Schaffner Mfg. Co., Inc. announces the availability of a new buffing and polishing wheel catalogue. It pictures, and fully describes, twenty-five wheels, their construction and recommended use.

The completeness of this catalogue makes it an informative reference medium.

L—909. Contact Back-up Wheels—A technical data book on the selection, application and operation of Cosmorubber contact back-up wheels for abrasive belt grinding and finishing is available. Also included is a section on industrial rollers.

The new booklet has been prepared by the Chicago Rubber Company, Inc.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PATENT ABSTRACTS

(Continued from page 1091)

No. 2,877,716, 3/17/59—Treatment to Increase Friction—J. Ryzner, assignor to National Aluminate Corp., Chicago, Ill.

Coating a railroad rail with a film of zeolite (Al_2O_3:SiO_2 ratio 1:2 to 1:5) is described.

12 claims, figure.

No. 2,878,146, 3/17/59—Deoxidizing Metal—A. Certa, assignor to Philco Corporation, Philadelphia, Pa.

To remove oxide from iron and steel articles immerse in a solution of aqueous hydrochloric acid (37 per cent) and ammonium chloride (10 g/100 ml of acid).

See also No. 2,878,189 an ammonium sulfate-sulfuric acid bath for removing oxides from Co-Ni alloys with 4 claims.

6 claims.

No. 2,878,149, 3/17/59—Oxidation of Copper—W. Mason, Minneapolis, Minn.

A solution for blackening copper consists of 3–12 lb of copper blackening agent (oxygen acids of Se and Te) a copper salt (15 per cent of blackening agent) 2 to 6 lb of As_2O_3, 110 to 170 fluid oz of H Cl, 2 to 4 lb of an alkylaryl sulfate, 5 to 20 gal of an alcohol and 22 to 54 gal of water.

4 claims.

No. 2,878,171, 3/17/59—Manufacturing Abrasive Surfaces—M. Ferrand, Toulon, France.

Claim 1 reads: "The method of producing abrasive tools, in the form of a continuous belt of bonding metal containing layers of even thickness of abrasive particles, including the steps of depositing successive layers of abrasive particles on a moving endless belt carrier in a cyclical process, and simultaneously and continuously depositing bonding metal on the carrier by electrodeposition at a rate such that particles of abrasive material deposited on the carrier become completely enclosed by bonding metal before the next succeeding deposition of abrasive particles on that portion of the belt occurs."

2 figures, 2 claims.

No. 2,878,172, 3/17/59—Silver Plating Stainless Steel Ware—A. Scavullo, assignor to V., C., F. Scavullo, Marie Saegert and Margaret Scott.

Nickel strike at 60–80 asf for 1 minute, cyanide copper strike for 30 seconds at 30 asf, cyanide silver strike for 30 to 60 seconds at 30 asf, then wire brush and plate with silver.

1 claim.

No. 2,878,553, 3/24/59—Rigidized Electrolytically Formed Metal Sheets—H. Hirsch, El Paso, Texas.

A rigidized electrodeposited sheet is claimed which is deformed from an initial planer shape by a set of interrupted, elongated corrugations.

1 claim.

No. 2,878,554, 3/24/59—Coating for Molybdenum—R. Long, assignor to Rand Development Corp., Cleveland, Ohio.

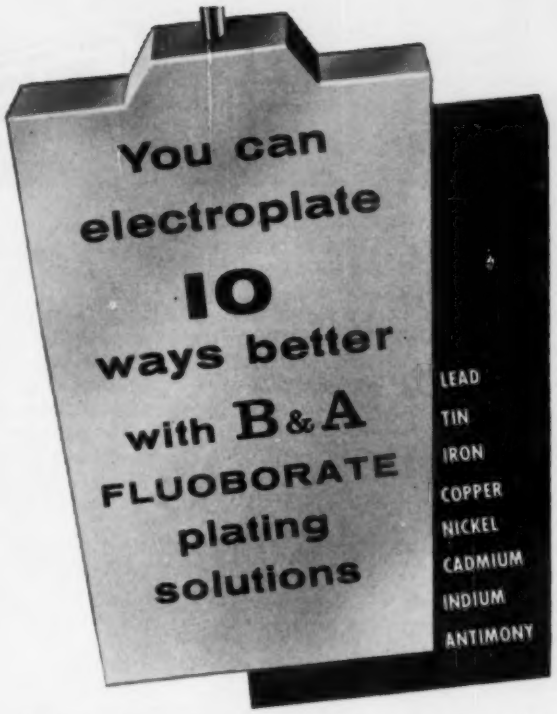
The coating described is 50–80 per cent nickel 15–40 per cent molybdenum and 8 to 20 per cent silicon and includes a fusion zone between the molybdenum and the coating.

7 claims.

No. 2,879,175, 3/24/59—Silvering Non-Metals—E. Umblia and E. Shulze, assignors to Telefonaktiebolaget Ericson, Stockholm, Sweden.

Activate with divalent tin ions, then with a solution containing silver, then use a silver solution where (Ag^{++}) is not more than 10^{-6} normal and (OH^-) is under 10^{-3} N along with a reducing agent active in alkaline solution. Then raise (OH^-) above 10^{-3} normal.

7 claims.



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PERSONALS

Ralph L. McGean has been elected president of The McGean Chemical Co.

He succeeds the late John A. McGean, who was an associate of John D. Rockefeller and who also served as president of Harshaw-Fuller and Goodwin Co. forerunner of Harshaw Chemical Co., before founding McGean Chemical in 1929.

Ralph L. McGean has been vice president and general manager of McGean Chemical since its founding.

Paul M. Savage, who has been a director as well as secretary, and in general charge of sales since the company's

R. L. McGean

P. M. Savage

D. L. Whitney

R. H Louden

founding, has been elected vice president. He is a graduate of Case Institute of Technology and a Trustee of the College.

Dickson L. Whitney, who has been with the company for seven years, will continue to serve as a director and as treasurer.

Robert H. Louden, who has been with McGean Chemical for 20 years has been elected secretary. Mr. Louden will assume the position of sales manager, assisted by Mr. Whitney.

Harry J. Beckemeyer, who previously taught ceramic engineering at Iowa State College for 12 years and served as senior research engineer for the Universal Rundle Corp., has joined McGean. Dr. Beckemeyer will be in charge of ceramic sales.

A few months ago, **Walter L. Pinner** joined McGean Chemical as manager of electroplating development. Mr. Pinner, previously with Houdaille Industries for 35 years, is the author of 50 technical papers on electroplating and nickel subjects, and has been responsible for many major developments in this field. He recently presided at the International Conference on Electrodeposition and Metal Finishing at Detroit.

The expansion and diversification program begun by McGean Chemical several years ago resulted in a Detroit plant and new buildings in Cleveland.

●

Richard D. Taylor has been appointed Regional Manager for the Eastern Division of Techline Division of Wheelabrator Corp.

Mr. Taylor, former Buffalo sales representative, will supervise the territories of Cleveland, Cincinnati, Buffalo, New England States, Metropolitan New York, and Philadelphia.

●

E. S. Nuspliger Jr. is the newly appointed director of advertising and publicity of Metal & Thermit Corp.

A graduate of Hamilton College with the Bachelor of Science degree, Mr. Nuspliger was a vice president and account group manager at G. M. Basford Co., New York. Prior to this he was an account executive with Moser & Cotins, Inc., Utica, N. Y. He was voted "Agency Man of the Year" in 1958 by the New Jersey Chapter, National Industrial Advertisers Association.

●

John J. Donohue has joined the sales staff of the Hubbard-Hall Chemical Co.'s industrial chemical division. Mr. Donohue was formerly New England representative of Wilson Martin, organic chemicals distributors. In his position with Hubbard-Hall, he will serve Connecticut textile, plastic and other manufacturing firms with the company's line of industrial chemicals.

●

L. Russell Munch has been appointed sales engineer in Ohio for Frederick B. Stevens, Inc.

Mr. Munch is a veteran in the metal finishing field with many years of experience at Namco Corp., Gerity Adrian Corp., McGean Chemical Company and the Packard Motor Car Co. Immediately prior to joining Stevens, he was with the Ohio Decorative Company of Wapakoneta, Ohio. Mr. Munch is a graduate of Adrian College, Adrian, Michigan having obtained a degree as a chemical engineer.

L. R. Munch

P. Sirian

Peter Sirian has been promoted to traffic manager of Frederic B. Stevens, Inc.

Mr. Sirian is a graduate of Western High School, Detroit and attended Wayne State University. He also attended the Graduate College of Advanced Traffic.

He has been assistant traffic manager at Stevens since 1953. Prior to joining Stevens he was employed with Standard Freight Lines.

●

George T. Stribling is now manager of sales for the Baker & Adamson line of laboratory reagents and fine chemicals of Allied Chemical Corporation's General Chemical Division.

A member of the Allied Chemical organization for 16 years, Mr. Stribling has been assistant manager of sales since 1955. Earlier in his career he served as a product development specialist and research technical supervisor.

Mr. Stribling is a graduate of Georgia School of Technology where he received a BS degree in chemical engineering in 1943.

●

James P. Farrell and **J. Steele Brown** have been named vice presidents of General Chemical Division, Allied Chemical Corp.

Director of sales for the past two years, Mr. Farrell will head sales of acids and other industrial chemicals, laboratory reagents and special products.

Mr. Farrell has been with Allied Chemical for 24 years and was previously a manager of sales for heavy chemicals.

Mr. Brown will be in charge of the division's production, mixing, purchasing and industrial service activities. He has been director of production for the past year.

Duane L. Ball, was recently appointed industrial department representative of Wyandotte Chemicals Corp. (J. B. Ford Division) Cleveland District.

Mr. Ball's shop experience started in the Ford Motor Co.'s Cleveland foundry. General production and laboratory work led to his becoming a foundry foreman for three years.

Later, with a Cleveland plating company, Duane Ball designed and supervised construction of plating fixtures and developed plating methods and procedures. He also performed considerable experimental work on metals. He will reside in Canton, Ohio.

D. L. Ball

R. W. Carnehl

Raymond W. Carnehl is a recent addition to Wyandotte Chemicals' Kansas City district. He is a representative for the J. B. Ford Division's industrial products line.

Mr. Carnehl has a ten-year background of service to distributors and customers.

His work has taken him into all of the north central states, and many midwestern states as well. He attended schools in Park Ridge, Illinois, and also Michigan State University, at Lansing.

●

Ralph W. Bailey has been named assistant general sales manager of the Federated Metals Division of American Smelting and Refining Co.

Mr. Bailey will retain his present position as sales manager of Asarco's continuous-cast products department. A native of Coshocton, Ohio he joined the company in 1945 as a sales engineer for continuous-cast products at Perth Amboy, New Jersey. In 1950 he was made district sales manager of the department, operating from Whiting, Indiana. He returned to Perth Amboy in 1955 as sales manager of the department. His new post will bring him to New York.

A 1934 metallurgy graduate of Yale University, Mr. Bailey received a masters degree in engineering and metallurgy from the University in 1936. Prior to his association with Asarco he was a metallurgist with Scovill Manufacturing Co. and United Aircraft Products.

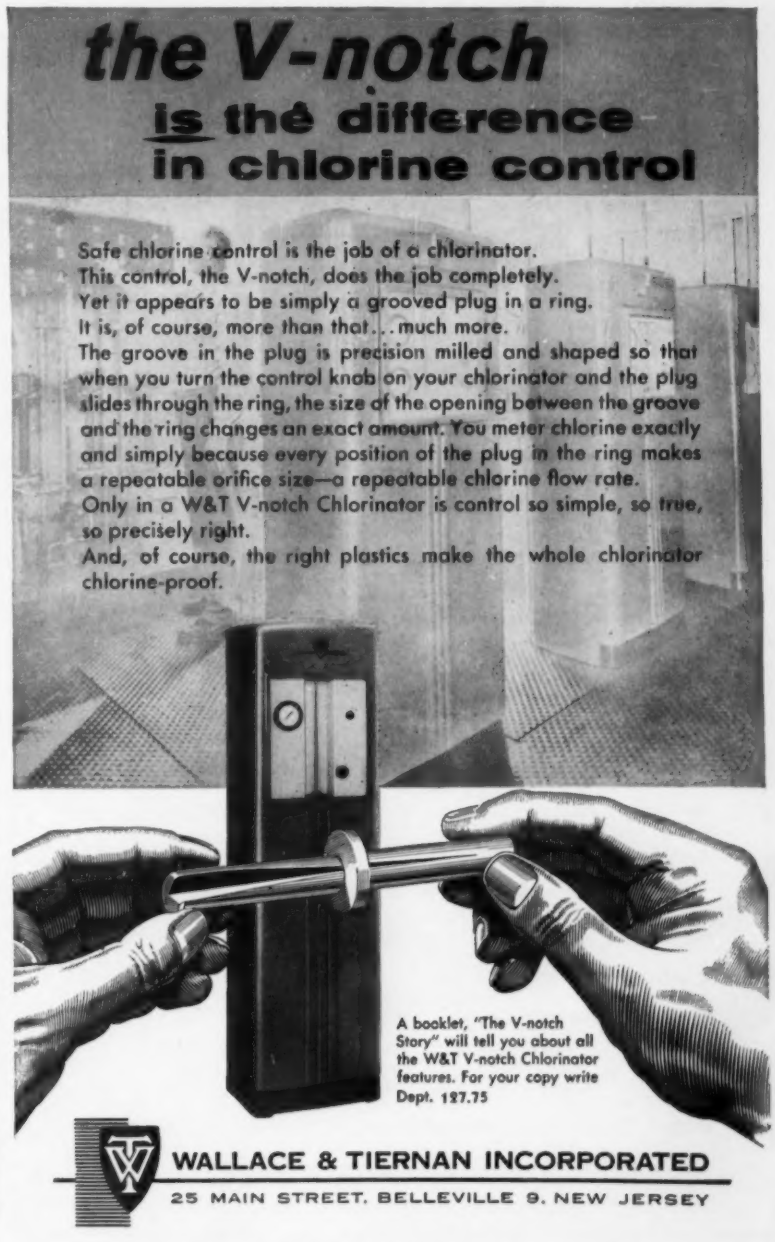
Herbert Kishbaugh has been promoted to manager, New York sales branch of Allied Chemical Corp.'s Solvay Process Division. He succeeds Fred H. Harris who is retiring after 34 years as a member of the Solvay sales organization.

A native of Pennsylvania, Mr. Kishbaugh is a graduate of the University of Tennessee. First employed in Solvay's advertising department in 1948, he was transferred to the Boston branch as a salesman in 1949. Six years later he was assigned to the New York branch office and on June 1, 1958, he was appointed assistant manager of that branch.

Wilbur H. Brumfield have been appointed to post of executive vice president and **Raymond Largent** to vice president of Allied Chemical Corporation's Solvay Process Division.

Bennett D. Buckles has been named assistant to the president; **Dr. Robert H. Reed** was appointed assistant director of development, succeeding Mr. Largent; **A. Gregg Noble** fills the newly created post of director of purchases; and **Dr. Herbert C. Wohlers** becomes director of research, the post formerly occupied by Dr. Reed' in organizational changes at Solvay.

Raymond C. Baxter, who has been Solvay's chief engineer, becomes assistant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director of operations, filling the post left vacant by Mr. Noble's promotion; **Richard A. Hiserodt** succeeds Mr. Baxter as chief engineer; **Robert K. Croll** was named assistant chief engineer, and **Dr. Alan G. Follows** was appointed assistant director of research.

●

Robert R. Burns, who joined National Aluminate Corp. in 1956 from Armour Chemical Division, Armour and Co., has been named manager, product development, succeeding **W. H. Thompson,** whose transfer to the Overseas Division was announced recently. Mr. Burns is a chemical engineering graduate of Oklahoma State University.

Lawrence L. Bott, formerly in petroleum industry chemicals, replaces Mr. Burns as product manager, industrial process chemicals. Mr. Bott holds a Bachelor's degree in chemistry from the University of Illinois and Master's and Doctor's degrees in chemistry from Rice Institute.

R. J. Jones

W. H. Ross

Wilford H. Ross has been appointed research supervisor of the Chemical Processing Division of Detrex Chemical Industries, Inc. and will be responsible for coordinating the research and development efforts on all chemical compounds and process in the division.

Robert J. Jones has been promoted to research supervisor of new process development at Detrex. Mr. Jones will coordinate the activities concerned with chemical process development, including pilot plant activities.

●

Fremont L. Scott has received the appointment of technical manager of the Organic Coatings Division, Metal & Thermit Corp.

Mr. Scott has been associated with the company's research operation since 1942.

Mr. Scott is an active member of the American Chemical Society, National Association of Corrosion Engineers, the Society of the Plastics Industry, the American Society for Testing Materials, and the American Electroplaters' Society.

He is a graduate of Boston College, where he received his BS and MS degrees in chemical engineering. Mr. Scott and his family reside in Scotch Plains, New Jersey.

●

Dariel E. Miller has been appointed district sales manager for Kelite Corp.

Mr. Miller has had more than 17 years of chemical research service and sales experience. For 11 years, he served as chemist and senior chemist for Kelite, and some of his work has led to the development of Kelite product and process patents.

Mr. Miller will be responsible for Kelite sales in the Company's San Francisco District.

D. E. Miller

R. J. Goodwin

Ralph J. Goodwin has been appointed Chicago district sales manager for Kelite Corp.

For the past two-and-a-half years, Mr. Goodwin has served as technical sales and service representative for Kelite.

●

George W. Hottel, field salesman in Diamond Alkali Co.'s New York branch sales office, has been promoted to staff assistant in the company's general sales and market planning department, Cleveland.

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So as to expedite review and other processing, please write the Editor, PLATING, 445 Broad Street, Newark 2, New Jersey, for full particulars before submitting your manuscript.

Jack G. Redmond is transferring to the post vacated by Hottel.

In 1942, following two years at Bethany College, Bethany, W. Va., Hottel enlisted in the U. S. Air Force, serving four years as an instructor in communications. Honorably discharged in 1946, he resumed his studies, attending Columbia University, New York, N. Y.

Mr. Hottel will relocate in Cleveland with his wife and two children.

Jack Redmond is a 24-year Diamond veteran whose experience centers chiefly in sales work at the company's Cincinnati branch office.

A graduate of Robert Morse School of Business, Pittsburgh, Pa., he also attended the University of Cincinnati, taking courses in business administration. Married, he plans to relocate in New Haven, Conn., with his wife, and three children.

•

Edwin F. Goad has been appointed marketing supervisor for coated abrasives and new products, coated abrasives and related products division, Minnesota Mining & Manufacturing Co.

Mr. Goad, who joined 3M Company in 1950 as a coated abrasives salesman, was previously at the St. Louis branch office. In his new post he will headquarter at St. Paul.

•

Gilbert Tint has been named vice president and chief engineer of the National Ultrasonic Corp., Irvington, N. J.

A member of the IRE and the Society for Non-Destructive Testing, he is a graduate of the College of the City of New York and holds a Master's degree in electrical engineering from Stevens Institute of Technology. Before joining National Ultrasonic Corporation, Mr. Tint served as chief engineer for Alcar Instruments, Inc.

•

Russell G. Heyl Jr. has been appointed chief engineer—research and development for American Metal Products Co. of Detroit. Two other members of the AMP engineering staff were named as his assistants.

Mr. Heyl, who came to AMP in 1950 from Fisher Body Division of General Motors, has been chief product engineer since 1956. He is a graduate of the University of Michigan.

John Hern, who has been with AMP since 1948, was appointed assistant chief engineer, in charge of body components.

Paul Thomas, with AMP for four years, will be assistant chief engineer, in charge of chassis components and non-automotive products.

Dr. Charles C. Winding, director of the School of Chemical and Metallurgical Engineering and professor of industrial chemistry at Cornell University, was elected to the board of directors at the annual meeting of stockholders of Cowles Chemical Co., Cleveland.

Dr. Winding received his B of ChE and PhD degrees from the University of Minnesota and has been a member of the Cornell faculty since 1935. He is a member of the American Institute of Chemical Engineers, American Chemical Society, Society of Plastics Engineers, Society for Engineering Education, and a Fellow of the American Institute of Chemists.

•

R. B. Preston has been promoted to manager of National Accounts of Detrex Chemical Industries, Inc.

In his new assignment, Mr. Preston and his staff will devote full time to the automotive industry and cover the entire United States.

Mr. Preston has 15 years of experience with Detrex, all of which has been spent in sales and chemical service in the pretreatment of metals prior to finishing.

•

Wilson B. Green, New Richmond, Ohio, has been appointed sales representative for the Techline Division of Whellabrator Corp. Mr. Green's territory includes the southern part of Ohio, the eastern half of Kentucky, and most of the state of West Virginia.

Mr. Green has been engaged for over 16 years in the field of metal processing and finishing, specializing in automatic processes in both the finishing and plating fields. He has been a representative for several leading manufacturers of custom-built finishing and processing equipment, chemicals and supplies.

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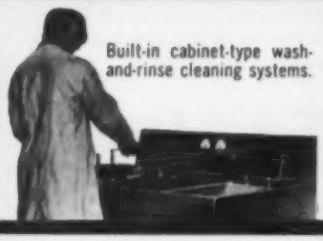

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Edward Herzig has been named to the technical staff of Frederick Gumm Chemical Co. in the capacity of research and development chemist. Mr. Herzig is a graduate of Rutgers University, and did his graduate work at Polytechnic Institute of Brooklyn. He has had a number of years experience in the precision plating of numerous precious metals, plating of plastics, etc. He was formerly supervising chemist, in charge of plating, with Seaboard Laboratories and the Electro-Tec Corp. He is a member of the American Chemical Society, American Electroplaters' Society, and American Society for Metals.

E. Herzig

R. J. Pinchot

Robert J. Pinchot, a factory representative who has been calling on accounts in the Cleveland area for several years, will be in charge of the new Schaffner Mfg. Co., Inc. Cleveland office. Mr. Pinchot has been in the metal finishing field for many years. His office is at 2614 Grovewood, Parma, Cleveland 29, Ohio.

●

David M. Roney Jr. has been named sales manager, equipment division for Hanson-Van Winkle-Munning Co.

Prior to this appointment, he was assistant sales manager with the company.

Mr. Roney, a U. S. Naval Academy graduate, served with the Navy nearly five years. Later, he attended the University of Pennsylvania Law School.

Previous to joining H-VW-M in 1955, Mr. Roney had been associated with Bendix Aviation Corp. as sales engineer and Westinghouse Electric Corp. as application engineering manager.

In his new appointment he will concentrate his activities on the overall management, coordination and advancement of the company's equipment product lines.

Willard J. Harper has been named chief engineer at Hanson-Van Winkle-Munning Co. In this capacity he will be in charge of all equipment design and engineering for the company's line of automatic metal finishing machinery.

Prior to his appointment, Mr. Harper was the company's chief mechanical engineer. In this capacity he was in charge of all mechanical design engineering. He joined H-VW-M June, 1957.

A mechanical engineering graduate of the University of Kentucky, Mr. Harper's previous experience has been with the hydraulic drives department of the Westinghouse Electric Corp. He was also associated with Hughes Aircraft Co.

●

Herbert A. Frankel of New York City has been appointed New York State regional sales manager of Narda Ultrasonics Corp. and **Marvin Klein** has been named midwest regional sales manager to head the company's branch office at 5785 North Lincoln Avenue, Chicago, which will service the Great Lakes area.

Mr. Frankel, a graduate of Massachusetts Institute of Technology and member of the American Institute of Mechanical Engineers, was formerly with General Ultrasonics Corp and has long been active as a manufacturer's representative in the chemical processing and metal finishing industry. His headquarters will remain at the plant in Westbury.

Mr. Klein, formerly a distributor of Narda SonBlaster products, will coordinate engineering, sales and service at the new Chicago office and warehouse.

●

Lester R. Albert Jr., owner of Carol Machine Tool Company of Ramsey, New Jersey, will represent Techline Division, Wheelabrator Corp. in the metropolitan New York area and in northern New Jersey. The New Jersey firm represents several suppliers to the precision finishing industry.

Gene A. Castle will represent Techline in the northern Indiana and northwest Ohio area. Mr. Castle has had extensive training in barrel finishing processing techniques as well as the sales and servicing of precision finishing equipment and supplies.

Robert H. Tiers, president of Torrington Chemical & Supply Co., Torrington, Connecticut, has been appointed to represent Techline Division in the states of Maine, New Hampshire, Vermont, Massachusetts, Connecticut and Rhode Island.

●

R. B. Parks, formerly San Francisco district manager for Raybestos-Manhattan, Inc. has been appointed assistant sales manager for the company's industrial rubber products and packings. A new marketing group section of its sales division has been established.

S. J. Synnott has been appointed general marketing manager of industrial rubber products and will direct activities of industrial rubber marketing managers assigned to specific product groups. Newly

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appointed members of this new rubber product group are: **H. J. Seeley,** marketing manager for Poly-V Drives and flat transmission belts; **A. Arguedas,** for conveyor and elevator belts, **J. J. Connors,** for rubber covered rolls. **G. E. Horvath** has been made marketing manager of mechanical packings.

R. E. Stiles replaces Mr. Parks as San Francisco district manager, **N. L. Rush,** previously manager of distributor sales of the Philadelphia District, has been appointed Minneapolis district manager.

•

Dr. C. Fred Gurnham has accepted the position of editor of Industrial Wastes, replacing Professor Don E. Bloodgood, who has been forced by the pressure of his duties at Purdue University to relinquish the post.

Dr. Gurnham, professor and head of the department of chemical engineering at Michigan State University, received his BS degree in chemical engineering from Yale University in 1932 and the MChE and DEngSc. degrees at New York University in 1940 and 1942 respectively. He was head of the department of chemical engineering at Tufts University, 1949–52, and assistant professor of chemical engineering at Pratt Institute, 1938–41. He has spent 15 years as a chemical engineer in industry.

Dr. Gurnham is a member of Phi Lambda Upsilon, Sigma Pi Sigma, Sigma Xi, Tau Beta Pi, the American Chemical Society, the American Institute of Chemical Engineers, the American Society for Engineering Education and the Federation of Sewage & Industrial Wastes Associations. He is a licensed professional engineer in New York, Michigan and Indiana.

•

Emile L. Rimbault Jr., has been appointed assistant sales manager of Lake Asbestos of Quebec, Ltd., wholly owned subsidiary of American Smelting and Refining Co.

Mr. Rimbault joined the Federated Metals Division of Asarco in 1946 as a sales trainee. For four years he was engaged in the division's sales operations in Houston, Texas; Whiting, Indiana; and Perth Amboy, New Jersey. In 1950 he was named assistant to the general sales manager of Federated and was in charge of advertising and market research for the division. Since 1957 Mr. Rimbault has been responsible for the market research activities of the Federated Division.

Born in New York City, Mr. Rimbault is a 1941 graduate of Princeton University, where he received a degree in chemical engineering.

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BRANCH NEWS

Total AES Branches U. S., Canada, Australia, August 1, 1959 — 58.

BRITISH COLUMBIA

Shepherd New President; Electroplating Course to be Held

Seventeen members and guests attended the June 24 meeting of the British Columbia Branch held at the White Spot Dining Room. President Jim Lee conducted the election of officers for 1959–60. The new officers are: N. A. Shepherd, president; Walter Kellermann, first vice president; Tom Wallington, second vice president; Norman McLeod, treasurer; Doug Armstrong, secretary; Gerald Amos, director-librarian; three additional members of the board of directors, Gordon Smith, Claus Schlossareck and Ralph Wolloschuk.

The evening electroplating course was favorably discussed. Nelson Shepherd reported briefly on the AES Detroit convention.

N. A. Shepherd
Secretary

BUFFALO

Lux to Speak on Metal Cleaning

The Buffalo Branch will hold its first meeting of the 1959–60 season Friday, Sept. 11, at the Niagara Manor, Buffalo, N. Y.

The technical session will feature a talk by **G. A. Lux** of Oakite Products, Inc. The subject will be "Some Fundamentals of Metal Cleaning" and will include: 1) the factors that enter into the selection of a metal cleaner, 2) the requirements of a modern metal cleaner and 3) some suggestions for the efficient use of metal cleaners.

Plans for the new season and reports on the Golden Jubilee Convention will be covered in the business session and will be of utmost importance to all Buffalo members.

The October and November meetings will be held the first Friday of the month. Time, place and speakers to be announced later.

Robert E. Lienert
Secretary

CINCINNATI

Annual Picnic Enjoyed

The Cincinnati Branch closed its 1959–60 year with its annual picnic at Sharon Woods on Saturday, June 27, with 70 members and guests present. The weatherman treated the group well as he gave them a clear hot day in which to carry out their activities.

The highlight of the afternoon was the annual ball game between the Suppliers and Platers, which was won by the Platers—5 to 3, and was one of the best played games in many years.

Other afternoon functions were the horseshoe tournament and egg tossing contests, which were won by the team of **Red Kemper** and **Carl Anderson.** The water filled balloon tossing contest was won by the team of **Joe Ryan** and **Jim Fry.**

The festivities were concluded with a steak dinner and a Monte Carlo evening and the drawings for the door prizes.

The committee, consisting of **Ray Barry, Stew Chipman, Jack Pfeiffer** and **Dick Snodgrass,** should be complimented on a job well done.

David L. Kaplan
Secretary

DALLAS-FORT WORTH

Brown Speaks on Crack Free Chromium; New Officers Elected

The May meeting of the Dallas-Ft. Worth Branch was held Wednesday, May 20, at the Zodiac Room of the Lennox Hotel in Grand Prairie, Texas. First Vice President **M. T. "Tommy" Norris** brought the meeting to order. Approximately 35 members and guests were in attendance, enjoying the newly redecorated Zodiac Room.

R. A. Brown of the Metal & Thermit Corp. spoke on "Crack Free Chromium" and the potential of this type of coating to the aircraft and electronic industry. Mr. Brown discussed properties, methods of application, and characteristics of interest to the engineering and designer. An interesting and well participated question and answer session followed.

Election of Branch officers for the 1959–1960 term saw the following candidates voted into office: President, **Myron E. Browning;** 1st vice president, **Wm. L. Aves Jr.;** second vice president, **Fred Howard;** secretary-treasurer, **A.C. Fricke;** recording secretary, **T. E. Betz;** program chairman, **D. L. "Don" Allie.**

Committees were instructed to liaison with members of nearby Branches for the formation of a Regional Group.

A. C. Fricke
Secretary

NEW HAVEN

Gaynes and Gessman Present Papers

The April 14 meeting of New Haven Branch was held in the New Haven Motor Guest Room. The meeting was called to order by President **Charles A. Kuster.** After hearing reports of various committees, President Kuster brought up the most important part "increase of Per Capita dues" by the Supreme Society. After a lengthy discussion it was moved and seconded to send the delegates fully instructed to vote against the proposal of increasing the Per Capita Tax from $5.70 to $10.00 per year.

N. Ismailoff, technical chairman, introduced Elliot Gessman of Olin Mathieson Chemical Corp. who spoke to the members on "Choice of Alloy and Process for Dyeing Anodized Aluminum." The second speaker was **Norman Gaynes** of Titanine Inc. who spoke on "Aircraft Finishing and Organic Coatings on Metals and Fabrics."

The meeting was well attended and members and guests heard the timely discussion of both these important subjects. A question and answer period followed each speaker's talk.

Following the technical session refreshments were provided by the New Haven Branch.

B. J. Gaffney
Secretary

NEW HAVEN

Winters Is Speaker; New Officers Elected

The New Haven Branch held its monthly meeting on Tuesday, May 12, in the New Haven Motor Inn.

President **Charles A. Kuster** presided

BRANCH SECRETARIES

Branch News is required of all Secretaries monthly by AES Bylaws. First of the month is Branch News deadline for next PLATING issue. Any items on hand on that date will be carried in that edition. Later arrivals will appear in the issue immediately following. In reporting talks given by speakers before the Branch, please give titles of the talks, the speakers' full identification and any other pertinent information of interest to other Branches and PLATING's broad readership.

and the various committee reports were heard. President Kuster reported on the Regional Convention.

Dr. Henry Kellner, chairman of the Nominating Committee brought in the following slate of officers for the year 1959–60: President, **George O'Connor Jr.**; vice president, **Harry R. Taylor**; secretary treasurer, **Bernard J. Gaffney**; librarian, **Edward F. Foley Jr.**; assistant librarian, **Edward R. Jorczek**; sergeant-at-arms, **Vincent J. Capuano**; historian, **William F. Bridgett**; board of managers, **Charles A. Kuster, Leonard F. Roberti, William K. Murray.**

The slate was given unanimous approval by the members. The Branch secretary awarded a past president pin to Charles Kuster. Technical Chairman O'Connor introduced **John Winters** president of Incar Inc., Cleveland, Ohio, who spoke on "Bright Cadmium and Zinc Plating." Mr. Winters gave a remarkable informative talk on his subject and it was voted one of the outstanding educational meetings.

The door prize was donated by Al. Kolb of Enthone Inc.

B. J. Gaffney
Secretary

NEW YORK

Winger Discusses Waste Disposal; Metropolitan Regional Announced

The meeting was called to order by President **Joseph Rembecki.**

One new application for membership from Martin W. Jawitz was forwarded to the Board of Managers. Four new members were unanimously elected and duly sworn by President **Rembecki.**

Friday, Sept. 25, 1959 has been designated as the first meeting of the coming season. This will be a joint educational session with the Newark Branch, to be known as Metropolitan Regional, our Branch being the host this year.

Librarian **Martin Pollack** introduced **Dr. Alvin G. Winger** of Rohm and Haas Co. Dr. Winger's talk on "Ion Exchange Treatment of Ionic Waste" was well received. He explained applications of ion exchange in plating solutions and waste disposal. There has not been too much call in the past for waste disposal use of ion exchange but further studies should find them applicable to the plating industry.

Fred Saras
Recording Secretary

MAIL BOX

DEAR SIR:

Glancing through your July issue of PLATING I noticed your fine report on Lee Congdon. I found it most interesting and I feel that Lee should be congratulated for all the fine work that he has done.

I thought you might be interested in knowing that I too, a high school junior, won a second prize in the Evansville Tristate Science Fair for an electroplating project: The Electrodeposition of Brass from Pyrophosphate Solutions. In this new process which I originated, deadly cyanides are completely eliminated. This solution appears to be stable and it is completely harmless. I feel that this process will be of considerable importance to brass plating.

At the present time I am gathering more supplies and equipment in order to perfect this process which I have discovered. If anyone might be interested in this process I would be happy to hear from them.

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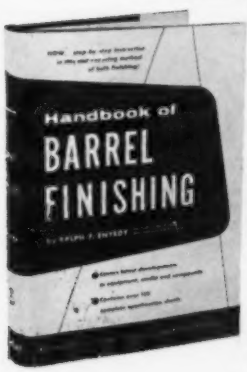

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AES MEMBERSHIP REPORT

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Blue Ridge: E. H. Garner, J. A. Hewitt, M. Milo
Bridgeport: C. Bennett, K. Higgins, G. B. Holcrith, F. Pioger
Columbus: M. R. Fulmer, C. C. Horning
Denver: W. T. Samuelson
Hartford: T. J. O'Brien Jr.
Melbourne: H. P. Cotter, W. G. Hinton, I. L. Howell, L. Janowska, B. Levy, G. Weidemann
New York: H. Borakove, W. Friede, V. Klein, J. Marjoribanks
Rochester: A. C. DeRoller
San Francisco: H. Boatsman, D. Dean, L. J. Dicks, L. R. Invin, D. E. Pierce, F. R. Prenson, R. L. Sendelbeck, J. C. Tervay
Southeastern: R. L. Gooding, R. S. Johnson
Sydney: E. F. Krah, M. Smidt
Syracuse: R. D. Byers, N. N. Cahan, J. F. Conoby, B. Ranney, T. M. Swain, D. E. Watson

REINSTATEMENTS

Milwaukee: G. McCormick
Philadelphia: N. G. Wallace

TRANSFERS

Bridgeport: H. Landsman to Cincinnatti
Columbus: S. C. Beach to Detroit
Los Angeles: L. Missel to San Francisco
Philadelphia: N. G. Wallace to Los Angeles
San Francisco: E. A. Flores from Boston, L. Missel from Los Angeles
Southeastern: O. W. Schneider to St. Louis
Twin City: C. P. Barth to Member-at-Large, N. A. Glenn to Member-at-Large, A. T. Leonard to Chicago, J. E. McDonald to Member-at-Large, F. E. Revell to Detroit, A. G. Russell to Member-at-Large, D. W. Schorr to Member-at-Large
Waterbury: F. T. Eddy to Los Angeles, J. D. Patrick to Detroit

RESIGNATIONS

Baltimore-Washington: D. G. Beretta, H. J. Huester
Bridgeport: C. Rogers, A. Tomis
Central Michigan: J. Czernecki
Columbus: R. G. Sheehan, R. C. Watson, D. R. Wells
Melbourne: J. C. Fitzpatrick, R. R. Read, M. P. Tickell, P. Tikotin
Miami: G. F. A. Mackay
Milwaukee: L. Brazier
New Haven: P. M. Cunningham, M. L. Freed
New York: M. Fannon
Philadelphia: R. W. Wirt
Saginaw Valley: C. P. Nankervis, E. Starkel, W. A. Sundwick
San Francisco: F. B. Axelrod
Southeastern: M. C. Robins
Sydney: E. J. Cousins, B. Harris, A. C. Moremon, R. D. Stewart, J. W. Van Oudheusden
Syracuse: A. Basilone, T. Yette
Member-at-Large: E. J. Dobbs, Birmingham, England; A. R. Galindo Jr., Mexico; M. Holt, Youngstown, Ohio; P. Mangold, Geneva, Switzerland; W. Rosche, Graz, Austria

SUSPENSIONS

Baltimore-Washington: C. W. Boll Jr., J. Conner, G. L. Greenstreet, M. H. Newman, W. C. Schaefer Jr., W. E. Turner
Blue Ridge: R. E. Anderson, S. P. Jackson, J. E. Mungenast, B. F. Rader, R. C. Stevens, H. R. Weaver
Central Michigan: E. J. Banner, W. P. Devan, M. Hebner, V. W. Irey, N. J. Lenneman, M. H. Little, W. F. Rowe, F. B. Smith, A. D. Webb, J. Woodley
Indianapolis: P. D. Girt, M. L. Grantham, S. D. Green, E. Perkins
Melbourne: G. W. Bloor, F. French, F. Quinton, L. Steward, W. R. Summerfield
New Haven: I. Brown, J. Chordas, J. F. Cook, V. D'Addio, W. T. Donahue, C. D. Iezzi, M. Iezzi, A. P. Jackson, E. G. Lindquist, R. O. Pelletier, A. J. Puopolo Jr., F. Torkaraki
New York: V. Capozzi, N. Heller, H. Levi, M. McCleave, V. J. Mineo, R. Operowsky, R. Piriano, I. M. Robbins, S. Rothstein, N. Suglia
San Francisco: I. Anderson
Seattle-Puget Sound: H. Adams, A. Davis, R. Martin, R. Olson
Southeastern: G. W. Asher, C. H. Hardman, W. D. Tidd, J. W. Wilson
Western Ontario: R. Corfield, M. R. Kirk

DEATHS

Member-at-Large: A. B. Canning, Birmingham England

BRANCH DIRECTORY CHANGES

BALTIMORE-WASHINGTON

Secretary: Edward J. Roach
1601 Woodbourne Avenue
Baltimore 12, Maryland
Meeting Place: National Bureau of Standards, Washington, D. C., and The Regent House Hotel, Baltimore, Maryland
Day of Month: Second Tuesday
Time: 8:00 p.m.

BRITISH COLUMBIA

Secretary: Douglas Armstrong
Huntington Rubber Company
Port Coquitlam, British Columbia
Meeting Place: White Spot Dining Room, 25th & Cambie Street, Vancouver, British Columbia
Day of Month: 3rd Wednesday of Month
Time: 6:30 p.m.

DENVER BRANCH

Secretary: Philip London
3160 Dover Drive
Boulder, Colorado

HOUSTON

Secretary & Treasurer: Harold Bartay
4313 Oleander
Bellaire 101, Texas
Meeting Place: Ram's Club Inc., 2710 Albany St., Houston, Texas
Day of Month: 3rd Tuesday
Time: 6:30 p.m.

INDIANAPOLIS

Secretary: Edna Rohrabaugh
1300 Burroughs Street
Lafayette, Indiana
Meeting Place: Construction League, 1456 N. Delaware St., Indianapolis, Indiana
Day of Month: 1st Tuesday of each month
Time: Dinner 6:30 p.m.—Meeting 8:00 p.m.

LOUISVILLE

Secretary: Charles C. Whitt
409 W. Broadway
Lawrenceburg, Kentucky

MIAMI

Meeting Place: 5000 East 10 Court, Hialeah, Florida
Day of Month: 3rd Friday of the Month
Time: 8:00 p.m.

MONTREAL

Meeting Place: Sheraton-Mount Royal Hotel
Day of Month: Second Monday of each Month
Time: 8:00 p.m.

NEW HAVEN

Meeting Place: Salen House Guest Lounge, New Haven Motor Inn, 100 Pond Lily Ave., New Haven, Conn.

PHOENIX

Secretary: James Weaver
6802 Paradise Parkway
Scottsdale, Arizona

PORTLAND

Meeting Place: Various
Day of Month: To Accommodate Speaker
Time: 6:30 p.m.

ROCHESTER

Secretary: Barrie M. Gardner
129 Ridgewood Road
Rochester 15, New York

SOUTHEASTERN

Secretary: H. R. Stogner Sr.
2631 Tilson Road
Decatur, Georgia

SYDNEY

Meeting Place: Theatrette, Sydney Technical College, Harris Street, Ultimo, Sydney, Australia

WATERBURY

Secretary-Treasurer: James R. Kennedy
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CLASSIFIED ADVERTISEMENTS

Only "Help Wanted" and "Situations Wanted" will be accepted. Rates: $.20 per word, minimum $5.00. AES Branch Members and Members-at-Large only, in good standing, are entitled (for personal use only) to a total of three free advertisements in any twelve-month period as of first insertion. Last day for inserting advertisements is the 10th of month preceding date of publication. When answering advertisements please address as follows: Box number, PLATING, 445 Broad Street, Newark 2, N. J.

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PLATING ENGINEER—Manufacturer of motor controls in the Wisconsin area is in need of a graduate in chemical engineering who has an interest in production engineering and electroplating background. State qualifications, age, expected salary and former employers. Reply to Box S3, PLATING, 445 Broad St., Newark 2, N. J.

PLATING ENGINEER—Leading national manufacturer of electronic wiring devices has an opening for a graduate engineer with a BS in Chemistry or Chemical Engineering. He should have 5 to 6 years experience in the plating field. This would be production work specializing in gold, silver, nickel and tin plating involving experimentation and development of new plating methods. Send resume to: AMP, Inc., 2100 Paxton St., Harrisburg, Pa.

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SALES REPRESENTATIVE—Expanding northeastern company, well established in the metal finishing trade, needs forward looking representatives to handle full line of metal cleaners and specialties, anodes, and allied chemicals. Several territories open and relocation may not be required. Salary and commission commensurate with sales and technical background. Our men know of this advertisement. Reply to Box S5, PLATING, 445 Broad St., Newark 2, N. J.

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AMERICAN ELECTROPLATERS' SOCIETY

September 12-13, 1959—**Executive Board,** Statler-Hilton Hotel, Detroit, Mich.

September 18, 1959—**Editorial Board,** National Headquarters, Newark, N. J.

September 25, 1959—**Research Committee,** National Headquarters, Newark, N. J.

September 25, 1959—**Metropolitan Regional Educational Meeting,** Joint meeting New York and Newark Branches, New York Host Branch, Penn-Top Room, 8 p.m., Hotel Statler, New York, N. Y.

October 3, 1959—**Montreal Branch,** 5th Annual Dinner-Dance, The Queen Elizabeth Hotel, Montreal, Canada.

November 7, 1959—**First Midwest Regional Conference,** All Day, Rockford College, Rockford, Ill. Sponsored by AES Midwest Regional Council.

December 4, 1959—**Detroit Branch,** Annual Meeting —National Officers Night—Symposium on Nickel Plating, Statler-Hilton Hotel, Detroit, Mich.

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December 8-9, 1959—**Dallas-Fort Worth Branch,** co-sponsored with the Southwest Society of Aircraft Materials and Process Engineers, Symposium on "Treatments and Finishes for Aerospace Materials," Hotel Texas, Fort Worth, Texas.

January 15-16, 1960—**Second Annual Dixie Regional Technical Session,** Saxony Hotel, Miami Beach, Florida. Sponsored by Miami Branch with Blue Ridge and Southeastern participating.

January 30, 1960—**Chicago Branch,** Annual Meeting and Banquet, Conrad Hilton Hotel, Chicago, Ill.

February 19-20, 1960—**Seventh Interim Meeting,** Philadelphia Host Branch, Ben Franklin Hotel, Philadelphia, Pa.

April 23, 1960—**Sixth Tri-State Regional Meeting,** Cincinnati Host Branch, Sheraton-Gibson Hotel, Cincinnati, Ohio.

April 23, 1960—**Twenty-First Annual New England Regional Meeting,** Bridgeport Host Branch, Hotel Statler, Hartford, Conn.

April 29-30, 1960—**Sixth Empire State Regional,** Southern Tier Host Branch, Mark Twain Hotel, Elmira, N. Y.

July 24-28, 1960—**47th AES Annual Convention,** Hotel Statler, Los Angeles, Calif.

June 18-23, 1961—**48th AES Annual Convention,** Hotel Statler, Boston, Mass.

June 25-28, 1962—**49th AES Annual Convention,** Schroeder Hotel, Milwaukee, Wis. Sponsorship Midwest Regional Council.

June 24-27, 1963—**50th AES Annual Convention,** Ambassador Hotel, Atlantic City. N. J. Sponsorship Newark Branch.

June 21-25, 1964—**51st AES Annual Convention,** St. Louis, Missouri

INTERSOCIETY

September 21-25, 1959—**Instrument Society of America,** 14th Annual Instrument-Automation Conference and Exhibit, International Amphitheater, Chicago.

October 7-9, 1959—**American Vacuum Society,** Sixth National Symposium on Vacuum Technology, Sheraton Hotel, Philadelphia, Pa.

October 11-16, 1959—**American Society for Testing Materials,** Pacific Area National Meeting (with Exhibit), Sheraton-Palace Hotel, San Francisco, Calif.

October 18-22, 1959—**The Electrochemical Society,** Fall Meeting, Deshler-Hilton Hotel, Columbus, Ohio.

October 21-24, 1959—**Federation of Paint and Varnish Production Clubs 37th Annual Meeting and 24th Paint Industries Show,** Convention Hall, Atlantic City, N. J.

November 2-6, 1959—**41st National Metal Exposition & Congress,** International Amphitheatre, Chicago, Ill.

November 5-7, 1959—**American Chemical Society,** Southeastern Regional Meeting. Symposium on Corrosion of Iron and Tin, Hotel John Marshall, Richmond, Virginia.

Nov. 30-Dec. 4, 1959—**27th Exposition of Chemical Industries,** New York Coliseum, New York City.

January 12-15, 1960—**Society of Plastics Engineers**—16th Annual Technical Conference, Conrad Hilton Hotel, Chicago, Ill.

January 26-27, 1960—**Society of Vacuum Coaters** Third Annual Meeting, Hotel Biltmore, New York City.

February 1-5, 1960—**American Society for Testing Materials,** Committee Week, Sherman Hotel, Chicago, Ill.

February 1-5, 1960—**Instrument Society of America,** Instrument-Automation Conference and Exhibit, Houston Coliseum, Houston, Texas.

March 9-11, 1960—**Instrument Society of America,** Temperature Measurement Symposium, Deshler-Hilton Hotel, Columbus, Ohio.

May 1-5, 1960—**The Electrochemical Society,** Spring Meeting, LaSalle Hotel, Chicago, Ill.

May 9-13, 1960—**American Society for Metals,** 2nd Southwestern Metal Exposition and Congress, State Fair Park, Automobile Building, Dallas, Texas

June 26-July 1, 1960—**American Society for Testing Materials,** 63rd Annual Meeting (with Apparatus Exhibit), Chalfonte-Haddon Hall, Atlantic City, N. J.

July 24-26, 1960—**National Association of Metal Finishers,** 5th Anniversary and Membership Meeting, Hotel Statler, Los Angeles, California.

July 25-26, 1960—**National Association of Metal Finishers,** 5th Anniversary Management Seminar, Hotel Statler, Los Angeles, California.

September 26-30, 1960—**Instrument Society of America,** Instrument-Automation Conference and Exhibit and 15th Annual Meeting, New York Coliseum, New York, N. Y.

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